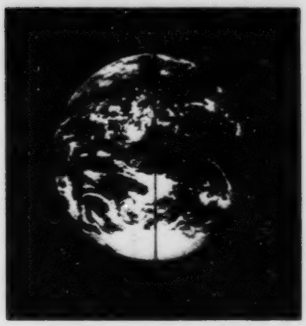
Government of Canada
Gouvernement du Canada

conference proceedings



Canada: a window on global mining

world-class

technology and

investment

prospects

Canadian Embassy

Tokyo, Japan

February 16 - 17, 1999

Canadä

FOREWORD

CANADA: A WINDOW ON GLOBAL MINING
World-Class Technology and Investment Prospects
Canadian Embassy, Tokyo, Japan
February 16 - 17, 1999

In 1996, after a successful joint-Foreign Affairs and International Trade Canada-Natural Resources Canada investment promotion seminar in Japan, the issue of a follow-up multi-day Mining in Canada event for Tokyo was raised informally by the Embassy.

This informal request was passed onto the Minister of Natural Resources Canada who fully supported the idea. As a result of this decision, and consultations between the Minerals and Metals Sector and Foreign Affairs and International Trade Canada (Canadian Embassy - Tokyo), an agreement was reached to organize a mining investment promotion conference in Tokyo entitled - *CANADA: A WINDOW ON GLOBAL MINING - World Class Technology and Investment Prospects* (February 16-17, 1999).

The aims of the Conference were:

- to maintain and increase Japanese interest in Canadian mineral properties and Canada's minerals and metals industry;
- to promote Canadian advances in mining, mineral processing and related technologies; and
- to show the Japanese that Canada can supply a full range of equipment and services to the world's mining community.

The Conference

The first day of the event focused on Canada's geology, Canada's minerals and metals industry (its diversity and strengths), mining financing and deal making in Canada, in addition to provincial presentations. The second day was more technical in nature and highlighted Canada's world-class expertise in exploration, mining, engineering and consulting services, environmental stewardship, and mineral/metal processing.

In addition to the formal program of the Conference, and responding to a request made by the Japan Mining Industry Association and the Metal Mining Agency of Japan, a mini-mining exhibition was also organized. Companies and organization were able to "showcase themselves" via table top displays/booths in an exhibition area at the entrance to the auditorium. Seven organizations were involved in the mining exhibition - the Geological Survey of Canada, the Government of Ontario, Hatch Associates Ltd., Watts, Griffis and McOuat Limited, Limtech (Lithium Metal Technology) Inc., Kitikmeot Geoscience Ltd., and Aird & Berlis, Barristers & Solicitors.

The event attracted some 150 senior mining, trading house, and banking executives throughout Japan and the Asia-Pacific region and was supported by the Metal Mining Agency of Japan.

Results

All presentations were exceptionally strong and each speaker represented a Canadian leader in the respective field. The first day of the event focused on Canada's geology, Canada's minerals and metals industry, mining financing and deal making in Canada, as well as provincial/territorial presentations. The second day highlighted Canada's world-class expertise in exploration, mining, environmental stewardship, and mineral/metal processing. The presenters were very encouraged with the reception and feedback that they received from the Japanese guests. Without question, the consensus view among Conference participants was that the event was a success.

A special thank you is extended to Mr. Douglas Buchanan and Davis & Company, Barristers & Solicitors, who most graciously hosted the luncheon on the first day of the Conference.

For more information about the event, please contact:

Dr. Dale L. Hull
Director
Economic Analysis Division
Economic and Financial Analysis Branch
Minerals and Metals Sector
Natural Resources Canada
580 Booth Street
Ottawa, Ontario
Canada
K1A 0E4

Tel: (613) 995-5301
Fax: (613) 943-8453
E-mail dhull@nrcan.gc.ca

CONTENTS

CANADA: A WINDOW ON GLOBAL MINING
World-Class Technology and Investment Prospects
Canadian Embassy, Tokyo, Japan
February 16 - 17, 1999

Section

PROGRAM 1

WELCOME LETTERS 2
Minister of Natural Resources Canada, the Honourable Ralph Goodale
Canada's Ambassador to Japan, His Excellency Leonard J. Edwards

WELCOMING REMARKS 3
Mrs. Jean McCloskey, Deputy Minister, Natural Resources Canada (Day One)
Mr. Hiroaki Hiyama, Chairman, Metal Mining Agency of Japan

OPENING REMARKS 4
Mr. Shimpei Miyamura, Chairman, Japan Mining Industry Association
Mrs. Jean McCloskey, Deputy Minister, Natural Resources Canada (Day Two)

CONFERENCE PAPERS

Mining and Minerals: Canada's Competitive Advantage 5
Dr. Dale Hull, Minerals and Metals Sector, Natural Resources Canada

Canada's Potential for New Mineral Wealth 6
Dr. Murray Duke, Geological Survey of Canada, Natural Resources Canada

Aboriginal Issues in the Canadian Mining Industry 7
Mr. Douglas Buchanan, Senior Partner, Davis & Co., Barristers & Solicitors

Finding a Project - Project Development Issues in Canada 8
Mr. John P. Steele, Director, PDAC, and President, Iriana Resources Corporation

Setting New Standards for Canadian Mining Companies on the Toronto Stock Exchange 9
Mr. Michael Bourassa, Partner, Aird & Berlis, Barristers and Solicitors

Global Mine Finance - Canada's Dominant Position 10
Mr. Ernest Nutter, Vice President and Director, RBC Dominion Securities

Yukon Mining Investment for the 21st Century 11
The Honourable Trevor Harding, Minister of Economic Development
Mr. Jesse Duke, Mining Facilitator, Mines and Resource Development Division

Ontario: A Canadian Leader in Mining Opportunities 12
Dr. John Gammon, ADM, Ministry of Northern Development and Mines

British Columbia: Strategic Advantages for Mining Investment 13
The Honourable Dan Miller, Minister of Energy and Mines

Nunavut: A New Territory to Explore 14
Mr. Gordon MacKay, Director (Designate), Minerals, Oil and Gas Division, Government of Nunavut

Mining and Aboriginal Issues: The Nunavut Territory 15
Mr. Charlie Lyall, President, Kitikmeot Corporation

Investing in Saskatchewan 16
Mr. Donald Koop, ADM, Finance and Administration, Saskatchewan Energy and Mines

The Quebec Mining Industry: A Profitable Investment 17
Mr. Duc Vu, Associate Deputy Minister (Mines), Ministry of Natural Resources

The Alberta Advantage in Mining and Minerals 18
Mr. Brad Klak, Managing Director, Alberta Japan Office

Environmental Stewardship and Mining 19
Mr. Robert Telewiak, Vice President, Environment, Falconbridge Limited

Research and Development at Inco Limited 20
Dr. Wm. Gordon Bacon, Vice President, Technology and Engineering, Inco Ltd..

Advanced Mining at Inco Limited 21
Dr. Greg Baiden, Manager, Mines Research, Inco Ltd

Mine Automation and Uranium Mining 22
Mr. W. L. (Bill) Murphy, Director, Marketing Asia & Canada, Cameco Corporation

Noranda: Growth through Technology 23
Dr. Irwin Itzkovitch, Senior Vice President, Shared Business Services and Chief Technical Officer, Noranda Inc.

Advanced Nickel Products at Inco Limited 24
Dr. Victor A. Ettel, Director, Product Research, Inco Technical Services Ltd.

Canada - Exploration Expertise and Opportunities 25
Ms. Deborah McCombe, President, Watts, Griffis and McOuat Limited

Environmental Technologies 26
Dr. George Poling, Senior Vice President, Rescan Environmental Services Ltd.

Consulting, Engineering and Project Management 27
Dr. Kurt Strobele, Managing Director, North America, HATCH

Addressing Industry Challenges through Technology 28
Mr. Don Downing, Vice President, Management Consulting, NorWest Mine Services Ltd.

Approval of Mining Projects in Canada: Examples from the Yukon and BC 29
Mr. Stephen R. Morison, M.Sc., Senior Geoscientist/Manager, Gartner Lee Limited

ADDITIONAL BIOGRAPHIES 30
Moderator and Mining Exhibitors
- Mr. Robert B. Parsons, Partner, PricewaterhouseCoopers
- Mr. John Broome, Geological Survey of Canada, Natural Resources Canada
- Mr. Gilles Dupuis, President and General Director (CEO), Lithos and Limtech

CONFERENCE-RELATED PRESS ARTICLES 31
Tekko Shimbun (Metal and Technology Daily)
Sangyo Shimbun (Daily Industry)
Kogyo Shimbun (Mining News)

CANADA: A WINDOW ON GLOBAL MINING
World-Class Technology and Investment Prospects
Canadian Embassy, Tokyo, Japan
February 16 - 17, 1999

EXHIBITION PROGRAM: FEBRUARY 16 - 17, 1999 (DAY ONE & TWO)

9:00 - 4:30 **Mining in Canada Exhibition** (Informational Displays)

Geological Survey of Canada
Government of Ontario
Hatch Associates Ltd.
Watts, Griffis and McOuat Limited
Limtech (Lithium Metal Technology) Inc.
Kitikmeot Geosciences Ltd.
Aird & Berlis, Barristers & Solicitors

CONFERENCE PROGRAM: FEBRUARY 16, 1999 (DAY ONE)

9:30 - 10:00 **Welcoming Remarks**

- Mr. Len Edwards, Canada's Ambassador to Japan
- Mrs. Jean McCloskey, Deputy Minister, Natural Resources Canada
- Mr. Hiroaki Hiyama, Chairman, Metal Mining Agency of Japan

Opening Remarks
Mr. Shimpei Miyamura, Chairman, Japan Mining Industry Association

Moderator's Introduction
Mr. Robert B. Parsons, Partner, PricewaterhouseCoopers (Indonesia)

10:00 - 10:30 **Mining and Minerals: Canada's Competitive Advantage**
Dr. Dale Hull, Director, Economic Analysis Division, Minerals and Metals Sector, Natural Resources Canada

10:30 - 11:00 **Canada's Potential for New Mineral Wealth**
Dr. Murray Duke, Director General, Minerals and Regional Geoscience Branch, Geological Survey of Canada, Natural Resources Canada

11:00 - 11:15 **Aboriginal Issues in the Canadian Mining Industry**
Mr. Douglas Buchanan, Senior Partner, Davis & Co., Barristers & Solicitors

11:15 - 11:30 **Finding a Project - Project Development Issues in Canada**
Mr. John P. Steele, Director/Member of the Executive Committee, Prospectors and Developers Association of Canada (PDAC), and President, Iriana Resources Corporation

11:30 - 12:00 **Setting New Standards for Canadian Mining Companies on the Toronto Stock Exchange**
Mr. Michael Bourassa, Partner, Aird & Berlis, Barristers and Solicitors

CONFERENCE PROGRAM: FEBRUARY 16, 1999 (continued)

12:00 - 12:30	**Global Mine Finance - Canada's Dominant Position** Mr. Ernest Nutter, Vice President and Director, Global Metals and Mining Group, RBC Dominion Securities
12:30 - 13:50	*Buffet Luncheon: Sponsored by Davis & Co., Barristers & Solicitors*
13:50 - 14:15 (1:50-2:15 p.m.)	**Yukon Mining Investment for the 21st Century** The Honourable Trevor Harding, Minister of Economic Development *and* Mr. Jesse Duke, Mining Facilitator and Special Acting Director, Mines and Resource Development Division
14:15 - 14:40 (2:15-2:40 p.m.)	**Ontario: A Canadian Leader in Mining Opportunities** Dr. John Gammon, Assistant Deputy Minister, Mines and Minerals Division, Ministry of Northern Development and Mines
14:40 - 15:05 (2:40-3:05 p.m.)	**British Columbia: Strategic Advantages for Mining Investment** The Honourable Dan Miller, Minister of Energy and Mines
15:05 - 15:20	**Refreshment Break**
15:20 - 15:40 (3:10-3:40 p.m.)	**Nunavut: A New Territory to Explore** Mr. Gordon MacKay, Director (Designate), Minerals, Oil and Gas Division, Government of Nunavut
15:40 - 16:00 (3:40-4:00 p.m.)	**Mining and Aboriginal Issues: The Nunavut Territory** Mr. Charlie Lyall, President, Kitikmeot Corporation
16:00 - 16:25 (4:00-4:25 p.m.)	**Investing in Saskatchewan** Mr. Donald Koop, Assistant Deputy Minister, Finance and Administration, Saskatchewan Energy and Mines
16:25 - 16:50 (4:25-4:50 p.m.)	**The Quebec Mining Industry: A Profitable Investment** Mr. Duc Vu, Associate Deputy Minister (Mines), Ministry of Natural Resources
16:50 - 17:15 (4:55-5:25 p.m.)	**The Alberta Advantage in Mining and Minerals** Mr. Brad Klak, Managing Director, Alberta Japan Office
17:15 - 17-30 (5:15-5:30 p.m.)	**End-of-Day Remarks** Mr. Robert B. Parsons, Partner, PricewaterhouseCoopers (Indonesia)
18:00 (6:00 p.m.)	**Reception**

CONFERENCE PROGRAM: FEBRUARY 17, 1999 (DAY TWO)

9:30 - 9:50	**Opening Remarks** Mrs. Jean McCloskey, Deputy Minister, Natural Resources Canada
	Moderator's Introduction Mr. Robert B. Parsons, Partner, PricewaterhouseCoopers (Indonesia)
9:50 - 10:20	**Environmental Stewardship and Mining** Mr. Robert Telewiak, Vice President, Environment, Falconbridge Limited
10:20 - 10:30	**Research and Development at Inco Limited** Dr. Wm. Gordon Bacon, Vice President, Technology and Engineering Inco Ltd..
10:30 - 10:50	**Advanced Mining at Inco Limited** Dr. Greg Baiden, Manager of Mines Research, Inco Ltd
10:50 - 11:20	**Mine Automation and Uranium Mining** Mr. W. L. (Bill) Murphy, Director, Marketing Asia & Canada, CAMECO Corporation
11:20 - 11:50	**Noranda: Growth through Technology** Dr. Irwin Itzkovitch, Senior Vice President, Shared Business Services and Chief Technical Officer, Noranda Inc.
11:50 - 13:10	***Buffet Luncheon:***
13:10 - 13:30 (1:10-1:30 p.m.)	**Advanced Nickel Products at Inco Limited** Dr. Victor A. Ettel, Director, Product Research, Inco Technical Services Ltd.
13:30 - 14:00 (1:30-2:00 p.m.)	**Canada - Exploration Expertise and Opportunities** Ms. Deborah McCombe, President, Watts, Griffis and McOuat Limited
14:00 - 14:30 (2:00-2:30 p.m.)	**Environmental Technologies** Dr. George Poling, Senior Vice President, Rescan Environmental Services Ltd.

CONFERENCE PROGRAM: FEBRUARY 17, 1999 (continued)

14:30 - 15:00 (2:30-3:00 p.m.)	**Consulting, Engineering and Project Management** Dr. Kurt Strobele, Managing Director, North America, HATCH
15:00 - 15:15 (3:00-3:15 p.m.)	**Refreshment Break**
15:15 - 15:45 (3:15-3:45 p.m.)	**Addressing Industry Challenges through Technology** Mr. Don Downing, Vice President, Management Consulting, NorWest Mine Services Ltd.
15:45 - 16:15 (3:45-4:15 p.m.)	**Approval of Mining Projects in Canada: Examples from the Yukon and British Columbia** Mr. Stephen R. Morison, M.Sc., Senior Geoscientist/Manager, Gartner Lee Limited
16:15 - 16:30 (4:15-4:30 p.m.)	**Closing Remarks** • Mr. Robert B. Parsons, Partner, PricewaterhouseCoopers (Indonesia) • Dr. Dale Hull, Director, Economic Analysis Division, Minerals and Metals Sector, Natural Resources Canada

Minister
of Natural Resources Canada

Ministre
des Ressources naturelles Canada

Ottawa, Canada K1A 0E4

Dear Participants:

I am pleased to welcome you to the Canadian Embassy in Tokyo for *CANADA - A WINDOW ON GLOBAL MINING: World-Class Technology and Investment Prospects*.

We are proud to showcase Canada's expertise in mining-related technologies and investment opportunities. Given the famous variations in our climate and geology, Canadians have developed a wide range of unique mining methods and technologies. Experts from Canada's federal and provincial governments and from some of our best-known private enterprises are here to share this information with you. They will also provide you with their insights into issues facing the world's mining community.

Over the next two days you are invited to attend presentations on various topics including mining standards and sustainable development, Canada's business and regulatory environment, our financial services sector, exploration and mineral processing technologies and mine automation.

I warmly encourage you to meet with our representatives to develop mutually beneficial ties. Once again, I welcome you to this important conference, and trust your time here will be enjoyable and profitable.

Sincerely,

Ralph Goodale

Canada

Minister
of Natural Resources Canada

Ministre
des Ressources naturelles Canada

Ottawa, Canada K1A 0E4

Chères participantes, chers participants,

Je suis heureux de vous accueillir à l'ambassade du Canada à Tokyo pour la conférence *LE CANADA : UN TREMPLIN VERS L'INDUSTRIE MINIÈRE MONDIALE – Possibilités d'investissement et technologie de pointe*.

C'est avec fierté que nous mettons ici en lumière l'expertise canadienne dans le domaine de la technologie minière et de l'investissement qui s'y rapporte. Le climat extrême et la géologie diversifiée de notre pays ont amené les Canadiens à mettre au point une technologie et une vaste gamme de méthodes d'exploitation minière uniques. Des experts des gouvernements fédéral et provinciaux du Canada et de quelques-unes de nos entreprises les plus connues sont sur place pour partager avec vous de l'information à ce sujet. Ils vous exposeront aussi leurs points de vue sur les questions auxquelles fait face la communauté minière mondiale.

Au cours des deux prochains jours, vous assisterez à des présentations qui porteront entre autres sur les normes et le développement durable dans le contexte de l'exploitation minière, le milieu des affaires et le régime de réglementation au Canada, notre secteur des services financiers, la technologie d'exploration et de transformation des minéraux et l'automatisation des mines.

Je vous incite vivement à faire la connaissance de nos représentants afin de nouer des liens qui s'avéreront mutuellement bénéfiques. Je vous souhaite une fois de plus la bienvenue à cette importante conférence. Je suis persuadé que vous y passerez des moments agréables et que vous en repartirez enrichis.

Veuillez agréer, chères participantes, chers participants, l'expression de mes sentiments les meilleurs.

Ralph Goodale

Canada

Government of Canada Gouvernement du Canada

Message from The Canadian Ambassador to Japan

Dear Participants:

On behalf of Canada, the provinces and territories and the outstanding Canadian companies participating, I am pleased to welcome you to this mining investment conference.

As Canada's Ambassador to Japan, I am truly proud to be able to have the Embassy and its facilities available to showcase Canada's strengths, our industry and our technological capabilities. Canada's mining industry has played a very important role in developing the important trade, economic and other beneficial relationships Canada and Japan now enjoy.

We expect that what you hear and see over the two days will provide interesting ideas as to how Canada and Japan can extend business relations in terms of both investment opportunities in Canada and employing Canadian technology and services to Japanese mining companies in a global context.

I encourage you to enjoy the Canadian Embassy facilities and the interesting program we have arranged. Thank you for taking the time to attend.

Leonard J. Edwards
Ambassador

Canada

Government of Canada Gouvernement du Canada

Message de l'ambassadeur du Canada au Japan

Chers participants:

Au nom du Canada, des provinces, des territoires et des compagnies canadiennes de premier plan qui y participent, j'ai le plaisir de vous souhaiter la bienvenue à cette conférence sur les investissements miniers.

En tant qu'ambassadeur du Canada au Japan, je suis particulièrement fier de voir l'Ambassade et ses installations mises à contribution afin de mettre en évidence les atouts du Canada, ses industries et son savoir-faire en matière de technologie. L'industrie minière canadienne a joué un rôle très important dans le développement des liens mutuellement bénéfiques qui unissent présentement le Canada et le Japon non seulement sur le plan des affaires et de l'économie mais dans bien d'autres domaines.

Nous croyons que ce vous verrez et entendrez durant les deux journées au cours desquelles la conférence se déroulera vous fournira un tas d'idées intéressantes sur la façon dont le Canada et le Japon peuvent accroître leurs liens d'affaires, qu'il s'agisse des occasions d'investir au Canada ou de mettre la technologie et les services canadiens à la disposition de compagnies minières japonaises dans un contexte mondial.

Je vous invite à profiter des installations de l'ambassade canadienne et du programme fort intéressant que nous avons préparé. Merci d'avoir pris le temps d'assister à la conférence.

Leonard J. Edwards
Ambassadeur

Canada

Welcoming Remarks

Mrs. Jean McCloskey
Deputy Minister of Natural Resources Canada

CANADA: A WINDOW ON GLOBAL MINING
World-Class Technology and Investment Prospects
Canadian Embassy, Tokyo, Japan
February 16, 1999

Mrs. Jean C. McCloskey

Deputy Minister
Natural Resources Canada

Jean C. McCloskey graduated from the University of Ottawa. She joined the public service in 1967 and worked in the areas of management consulting, industrial development and export promotion in the former Department of Industry, Trade and Commerce.

In 1982, she moved to the former Department of External Affairs and International Trade where she held successively more senior positions. Her last assignment was as Assistant Deputy Minister, Asia Pacific. She was a member of the Board of the Asia Pacific Foundation of Canada and of the Canadian Committee for Asia-Pacific Economic Cooperation.

In November 1991, Mrs. McCloskey was named President and CEO of Investment Canada. She moved to the Department of Finance as Associate Deputy Minister in June 1993.

In May 1994, Mrs. McCloskey was appointed Deputy Minister of Natural Resources. She is a member of the boards of Forintek Canada, the Canadian Investment Development Corporation, the Canadian Hibernia Holding Corporation, Learning for a Sustainable Future and the Ottawa Hospital.

Welcoming Remarks

Ambassador Edwards, Hiyama-San, Miyamura-San, honoured guests. Good morning, and thank you, Ambassador, for your kind remarks.

It is my privilege and pleasure to be here to open these proceedings. I extend a warm welcome to you all. Our conference — Canada: A Window on Global Mining — is a window we want to open wide for you, to see the many marvelous opportunities Canada has to offer in this important sector.

I am also pleased to convey a message of welcome from Canada's Minister of Natural Resources, the Honourable Ralph Goodale. As many of you already know, Minister Goodale is a strong supporter of the work of the mining sector.

In particular, he has asked me to encourage you to meet with our Canadian representatives in Tokyo over the next two days.

These are senior people from our federal, provincial and territorial governments, leading industry representatives, and financing experts.

Our mission is to broaden your knowledge of Canada's mineral and mining sector.

I am sure my colleagues will be able to answer your questions — questions that a prudent investor would ask before making any investment — questions about our management experience and expertise, our business environment, our industrial vitality, the availability of qualified labour and our technological innovation.

Let me highlight the key elements of Canada's continued achievement in mining management.

We have a wealth of mining experience. For instance, approximately 300 mines currently operate in Canada, along with some 3,000 sand and gravel operations.

We are aggressive prospectors. In 1997, over $800 million was spent on exploration in Canada, and large Canadian companies account for over $1.9 billion, or one-third, of the world's total exploration expenditures.

We are also efficient prospectors. We can overcome the most challenging of conditions. Our diverse geology, variable climate (to say the least), and vast distances have seen to that.

You may not know that we already produce 60 mineral commodities, and more discoveries are being added every year.

For example, in recent years very considerable deposits of nickel, copper, and now diamonds have been discovered.

Thus, Canadians have learned that successful mining ventures depend on a number of different elements. These elements all have to be in place before the wise investor proceeds:

- adequate financing;
- recognition of the cyclical nature of commodity prices (making this a particularly good time to invest);
- political stability;
- a balanced regulatory framework that recognizes the need for sustainable development; and
- an array of new technologies — robotics and mine automation for example — harnessed to traditional expertise in ore analysis, surveying, mine design, systems engineering, extraction technologies, waste recycling and disposal, mine-site reclamation and safety systems.

Let us start with financing.

Without adequate investment capital, the earth's resources stay where they were created — in the ground.

Canada's investment climate is excellent.

In 1997, almost 50 percent of the more than $10 billion raised for exploration and mining in the world came from Canadian capital markets.

That is twice the level of the London Stock Exchange, more than twice Sydney's, and it dwarfs the United States' share of a mere four percent of the total.

As far as capital is concerned, Canada is the centre of the global mining business.

Once financing is in place, you will find the Canadian tax regime is stable and even-handed. It favours capital-intensive industry.

Foreign investment in our mining sector is welcome.

And our free-trade agreements with the United States, Mexico and Chile encourage the unhindered movement of capital.

I do not have to tell anyone here that prosperity loves stability. The flight of capital from some countries in the western Pacific Rim in recent years proves as much.

Canada is as strong and stable a country as any on earth. It is second to none where quality of life is concerned. Our business environment is solid. The economy is healthy; inflation and interest rates are low.

We have a large, mobile, highly trained and well-educated workforce with the highest number of university graduates of any country in the world.

Over the last decade, our mining productivity has increased by almost 50 percent.

We have an excellent inter-modal transportation system.

We are world leaders in telecommunications.

As demonstrated by the number of provincial representatives with us today, cooperative federal-provincial relations clearly enhance trade and encourage investment.

All this and more has made Canada a serious contender in the competition for the world's mining business.

Canadians respect their environment. So do their governments.

We have implemented the policy of sustainable development of minerals and metals — integrating economic, environmental and social factors — and we are promoting our ideas internationally.

Our strategy is based on sound management and sound science — the principle of "Safe Use." It promotes an approach of "stewardship" of the earth's resources, not simply their exploitation.

It says that a mineral or metal must be used responsibly throughout its life-cycle to protect the environment and maximize the health and safety of producers and consumers.

We are fully aware that there are emerging international issues targeting minerals and metals. However, we are convinced that metals and minerals can be produced and used responsibly and safely.

Canada is willing to work with other countries — such as Japan — to ensure that initiatives affecting the production of minerals and metals are based on sound scientific information.

We also wish to ensure that such initiatives do not unduly limit the use and the trade in minerals and metals.

In addition, we increasingly see social or community issues becoming a significant factor in exploration and mine development, particularly in remote areas.

In my view, these issues will become more and more important in developing mines successfully, and will need to be addressed by industry and governments.

Canada's approach builds on our high environmental standards — high, but realistic.

So, while domestic environmental concerns have caused us to look carefully at the impact of mining activities, they have also stimulated the mining industry to find solutions that have made us leaders in the profitable practice of safe, clean mineral exploration and extraction.

We know this policy of enlightened stewardship is shared by like-minded governments and industrial partners.

Excellence is a word too often welded to "technology," but in Canada's case, technology plus experience equals significant benefits.

Canada will continue to lead in developing and improving new technologies such as airborne and space-based geophysical surveying, robotics, machinery electronics, computer modeling and telecommunications. A number of these topics will be discussed here tomorrow.

Clearly, Canada is a global leader in mineral exploration and production.

We are currently one of the world's largest producers of potash, uranium, nickel, zinc, copper and gold, to name but a few.

However, to reach new levels of production, our traditional skills and expertise will be closely tied to emerging new technologies.

Canada will address the challenges of the next century by maintaining our balanced approach toward sustainable development, environmental stewardship, stable financing, sound management and innovative technologies.

The mines found, planned, opened up and worked by Canadians, whether in Canada or in hospitable and less-than-hospitable locations around the world, are clean, safe, well-run, environmentally friendly and prosperous.

We invite you to explore these prospects for yourselves. We hope you will find we have common goals and common interests.
That is why we are here: to promote our vision of a mutually prosperous future for our industries, our workers and our economies.

Ladies and gentlemen, I thank you. I hope you enjoy the rest of the day's proceedings, and I look forward to seeing you here tomorrow.

Welcoming Remarks
Mr. Hiroaki Hiyama
President of the Metal Mining Agency of Japan

CANADA: A WINDOW ON GLOBAL MINING
World-Class Technology and Investment Prospects
Canadian Embassy, Tokyo, Japan
February 16, 1999

Thank you for the introduction. I am Hiroaki Hiyama of the Metal Mining Agency of Japan. I would first of all like to thank all those who worked so hard to organize this event. The seminar came about thanks to the enthusiastic cooperation of Natural Resources Canada and the Department of Foreign Affairs and International Trade. We of the Metal Mining Agency of Japan accepted the invitation to co-sponsor this seminar because it is a valuable opportunity to exchange information with Canada, a world leader in mining, and to provide information to people in mining-related businesses. I would like to take this opportunity to thank Ambassador the Honourable Leonard Edwards and Deputy Minister Jean McCloskey for their parts in making this important seminar a reality.

Although the activities of the Metal Mining Agency of Japan have centred mainly on exploration, we have also been working the past few years on environmental protection and information services. In addition to data on geology and mineral deposits, we are endeavouring through a variety of means to provide information on exploration, environmental technology, mining-related laws and investment climates. We believe that through these kinds of exchanges we can expand our information base, reduce the risks involved in mining resource development, and contribute to increased mining activity.

As you all know, Canada is richly endowed with mineral resources and holds a top place in the world both in terms of deposits and in terms of production. In addition, it is continually a world leader in terms of exploration activity. Canada and Japan have already developed a close relationship, and Japanese companies are involved in many Canadian mining exploration and development projects. I think that says something about Canada's consistency, stability and reliability as a world supplier of resources. The Metal Mining Agency of Japan has an office in Vancouver which strives to maintain two-way exchange of information between Japan and Canada.

At this seminar we will hear from people representing Canada's federal government, provincial governments, corporations, and research institutions. They will of course tell us about Canada's rich mineral resources, but also present a truly wide range of topics including the mining investment climate, cutting- edge mining technology, and environmental protection. It is in anticipation of learning more about Canada's mining potential and of having an opportunity to exchange the most up-to-date information that I welcome you to this seminar today.

(Canadian Embassy Translation Services, Tokyo)

Hiroaki Hiyama

President
Metal Mining Agency of Japan

Date of Birth: January 15, 1933

Education: University of Tokyo
Mining Engineering

Career:

1957	Joined Ministry of International Trade & Industry
1978	Director, Mine Safery Div., Industrial Location and Environmental Protection Bureau
1980	Director, Coal Industry Div., Coal Dept.
1984	Director-General, Coal Dept. Agency of Natural Resources & Energy
1985	Director-General, Tokyo Bureau of International Trade and Industry
1986	Executive Director, New Energy and Industry Technology Development Organization
1992	Vice President, Japan Mining Industry Association
1994	Executive Director, Japan Mining Industry Association
1995	Vice President, The Association for Overseas Technical Scholarship
1997	President, Metal Mining Agency of Japan

Opening Remarks
Mr. Shimpei Miyamura
Chairman of the Japan Mining Industry Association and
President of Mitsui Mining & Smelting Co.,Ltd.
February 16, 1999

Ambassador Edwards, Distinguished Ministers, officials and the other members of the Canadian delegation, ladies and gentlemen.

On behalf of all the guests, I would like to thank our Canadian friends for hosting this Conference, in association with the MMAJ.

With so many negative reports on the state of Japanese economy in recent months, I believe that many of you who are visiting from Canada are interested to find out if the Japanese non-ferrous industry will be viable in the long run.

I cannot deny the fact that our industry has been dealt a number of severe blows. And in fact, the troubles facing us are five fold:
(1) low metal prices,
(2) unfavourable exchange rates,
(3) slack in demand,
(4) reduction in metals import tariffs, and
(5) tight supply of concentrates.

Don't worry. I know this is not the right time to be negotiating with you! However, I am sure you can appreciate the trying circumstances we are facing.

To overcome the current situation, our base metals industry is taking drastic actions to reduce costs and I believe that our efforts will result in achieving our objectives sooner, rather than later. Of course, it is our keen desire that the massive economic stimulus packages, as well as the structural reforms, being implemented by the Japanese Government, will help to expedite this process.

In my capacity as Chairman of the Japan Mining Industry Association, I am continuously communicating to the Japanese Government that, despite the current severe economic conditions, it is of utmost importance for Japan to maintain medium to long term, reliable sources of resources from overseas.

I therefore believe that this Conference is most timely, as it is providing us with the opportunity to generate some fresh ideas on investing in Canada, and elsewhere through joint ventures with Canadian companies.

In closing, I wish every success of this two-day Conference.

Thank you.

Shimpei Miyamura

President
Mitsui Mining & Smelting Co., Ltd.

Date of Birth: August 3, 1934

Education: The Faculty of Law
University of Tokyo
March 1958

Recreation: gold, reading, classical music

Career:	April, 1958	Joined Mitsui Mining & Smelting Co., Ltd. and was assigned to Hikoshima Smelter
	1964-1979	General Administration Sector of Miike Smelter
	1979-1983	Corporate Management & Planning Office
	1983-1987	General Manager of Personnel Dept.
	1987-1989	Director and Senior General Manager General Administration Headquarters
	1989-1991	Managing Director
	1991-1992	Senior Executive Managing Director
	1992-1993	Executive Vice President
	1993- present	President

Directorship:

Director, Onahama Smelting & Refining Corporation (Mitsui 4%), Chairman, Powdertech Co., Ltd. (34.6%), Chairman, Hibi Kyodo Smelting Co., Ltd. (63.5%), Chairman, Nihon Mesalite Industry Co., Ltd. (58.75%), Director, Overseas Mineral Resources Development Co., Ltd. (6.43%), Director, Nishi Nippon Electric Wire & Cable Co., Ltd. (19%), Director, Hachinohe Smelting Co., Ltd. (57.7%)

Membership of committees and industry bodies:

Executive Member of the Board of Directors of Keidanren (the Federation of Economic Organizations)
Trustee of Japan Committee for Economic Development Executive Director of Nikkeiren (the Japan Federation of Employers' Association), Chairman of Japan Mining Industry Association

Opening Remarks
Mrs. Jean McCloskey
Deputy Minister of Natural Resources Canada

CANADA: A WINDOW ON GLOBAL MINING
World-Cass Technology and Investment Prospects
Canadian Embassy, Tokyo, Japan
February 17, 1999

Good morning. It is my privilege and pleasure to be here again to open the second day of this two-day conference. Once again, I would like to extend a warm welcome to you all.

Yesterday, senior people from our federal, provincial and territorial governments, leading industry representatives and financial and legal experts, addressed the issue of Canada's geological endowment, and Canada's investment climate and regulatory framework.

Proceedings today will focus on Canadian technology and Canadian service providers to the mining sector.

Though I made this point yesterday, I want briefly to highlight the key elements of Canada's continued achievement in full-service mining management.

We have a wealth of mining experience. For instance, approximately 300 mines currently operate in Canada, along with some 3000 sand and gravel operations.

We are aggressive prospectors. In 1997, over $800 million was spent on exploration in Canada, and large Canadian companies account for over one-third, of the world's total exploration expenditures.

We are also efficient prospectors. We can overcome the most challenging of conditions.

You may not know that we already produce 60 mineral commodities, and more discoveries are being added every year.

Thus, Canadians have learned that successful mining ventures depend on a number of different elements. These elements all have to be in place before the wise investor proceeds:

- adequate financing;
- recognition of the cyclical nature of commodity prices (making this a particularly good time to invest);
- political stability;
- a balanced regulatory framework that recognizes the need for sustainable development; and

- an array of new technologies — robotics and mine automation — harnessed to traditional expertise in ore analysis, surveying, mine design, systems engineering, extraction technologies, waste re-cycling and disposal, mine-site reclamation and safety systems.

Let us start with financing.

Without adequate investment capital, the earth's resources stay where they were created — in the ground.

In 1997, almost 50 percent of the more than $10 billion raised for exploration and mining in the world came from Canadian capital markets.

As far as capital is concerned, Canada is the centre of the global mining business.

I do not have to tell anyone here that prosperity loves stability. The flight of capital from some countries in the western Pacific Rim in recent years proves as much.

Canada's investment climate is very stable.

I am also very pleased to underline the positive economic news announced by our Minister of Finance, the Honourable Paul Martin, just hours ago, in his recent budget speech in Ottawa.

The government is committed to balanced budgets or better in both 1999-2000 and 2001-01, marking four consecutive years in which the budget will be in balance or surplus. This has happened only twice in Canada's 132 year history.

Furthermore, this will be achieved at the same time as tax reductions (elimination of personal surtax and a reduction in employment insurance premiums) are implemented.

Lower taxes will provide increased rewards for work, saving and investment.

The Canadian government is also making a continuing commitment to encouraging innovation in the economy.

Over the next three years, the Government will inject some $100 million into Technology-promoting institutions including - Technology Partnerships Canada, the Networks of Centres of Excellence program (which facilitates the transfer of knowledge among world-class researchers), the Canadian Space Agency, the Natural Science and Engineering Research Council, and the Business Development Bank of Canada - increasing its ability to provide financing to knowledge-based and export-oriented companies.

Additional funds have also been allocated to the Canadian Foundation for Innovation and the National Research Council.

Finally, $96 million, over the next 3 years, to support the GeoConnections initiative, which makes geographic-related information more accessible.

This will ensure that Canada stays at the forefront of mapping and its application - something that will be of particular interest to the mining sector

This Budget demonstrates that the finances of Canada are now in better shape than they have been in a generation and will ensure that Canada's quality of life remains second to none.

These budget measures augment Canada's impressive record in building a knowledge-based workforce.

We have a large, mobile, highly-trained and well-educated workforce with the highest number of university graduates of any country in the world. Over (roughly) the last decade, our mining productivity has increased by almost 50 percent.

Canadians respect their environment. So do their governments. We have implemented a policy of sustainable development of minerals and metals — integrating economic, environmental and social factors — and we are promoting our ideas internationally.

Our strategy is based on sound management and sound science — the principle of "Safe Use." It promotes an approach of "stewardship" of the earth's resources, not simply their exploitation.

It says that a mineral or metal must be used responsibly throughout its life-cycle to protect the environment and the health and safety of producers and consumers.

We are fully aware that there are emerging international issues targeting minerals and metals.

However, we are convinced that metals and minerals can be produced and used responsibly and safely.

Canada is willing to work with other countries — such as Japan — to ensure that initiatives affecting the production of minerals and metals are based on sound scientific information.

We also wish to ensure that such initiatives do not unduly limit the use and the trade in minerals and metals.

Canada's approach builds on our high environmental standards — high, but realistic. As proof, I can say that mining activity in Canada is vital and vibrant.

Since 1989 we have opened 99 new mines, and we expect to open a further 40 new mines over the next three years.

What makes this possible and profitable is the innovative application of cutting-edge Canadian technology and research.

So while domestic environmental concerns have caused us to look carefully at the impact of mining activities, they have also stimulated the mining industry to find solutions that have made us leaders in the profitable practice of safe, clean mineral exploration and extraction.

I am sure that Robert Telewiak, Vice-President, Environment, for Falconbridge, and Dr. George Poling of Rescan Environmental Services Ltd., will have more to say on this subject today.

We know this policy of enlightened stewardship is shared by like-minded governments and industrial partners.

Excellence is a word too often welded to "technology," but in Canada's case, technology plus experience equals significant benefits.

There is no doubt Canada will forge ahead in developing and improving new technologies such as airborne and space-based geophysical surveying, robotics, machinery electronics, computer-modeling and telecommunications.

Senior officials with three of our most successful mining companies — Noranda, Inco and Cameco — are at this conference and will be telling you how their companies are leading the way in technological development.

These technologies will result in increased productivity, enhanced environmental safeguards, improved worker safety, and deeper, lower-grade ore exploration.

Right now we are one of the world's largest producers of potash, uranium, nickel, zinc, copper and gold, to name but a few. To reach new levels of production, however, our traditional skills and expertise will be closely tied to emerging new technologies.

Clearly, Canada is a global leader in mineral exploration and production. The next century will bring us many mining challenges.

We invite you to explore Canada's technological abilities and our ability to supply mining-related services anywhere in the world.

I hope you will explore these intriguing prospects for yourselves. We hope you will find we have common goals and common interests.

That is why we are here: to promote our vision of a mutually prosperous future for our industries, our workers and our economies.

I will now pass you over to our conference moderator, Mr. Robert Parsons, of Price-Waterhouse-Coopers.

For those of you who were not here for the first day of the conference, Mr. Parsons is a partner in Price-Waterhouse-Cooper's Jakarta office, where he heads the firm's Indonesian mining practice. Prior to transferring to Jakarta in 1997, Mr. Parsons was based in Toronto, where he served as chairman of the firm's global mining practice.

Thank you. I hope you enjoy the rest of the day's proceedings

Mining and Minerals:

Canada's Competitive Advantage

Dr. Dale L. Hull
Director, Economic Analysis Division
and
James Lauer
Financial Policy Analyst
Minerals and Metals Sector, Natural Resources Canada

Tokyo, February 16, 1999

Dr. Dale L. Hull

Director,
Economic Analysis Division,
Minerals and Metals Sector, Natural Resources Canada

Dr. Dale Hull has been with Natural Resources Canada (NRCan) as Director, Economic Analysis, Minerals and Metals Sector since 1984. Prior to moving to NRCan, Dr. Hull held a position as Associate Professor of Economics at Memorial University of Newfoundland. In both his academic and government careers, Dr. Hull has concentrated his work in the areas of international trade and finance and natural resource economics, including forestry and mining.

Dr. Hull's responsibilities with the Government of Canada have been in the areas of mineral policy development and mining taxation. Over the last several years, Dr. Hull has been active in the Government of Canada's efforts to promote international investment in Canadian mining. These activities have taken him to major financial and mining centres throughout the Asia-Pacific region and North and South America.

Dr. Hull has a Ph.D in Economics from McGill University, Montreal, Canada.

INTRODUCTION

Mining and Minerals: Canada's Competitive Advantage

Good morning honoured guests, ladies and gentlemen. It is a pleasure to be here today and to be the first presenter.

My remarks today will focus on Canada's mining and minerals industry. I will try to give a broad overview, setting the stage, so to speak, for the next two days of speakers.

Four factors have basically given Canada its standing as one of the world's major mineral producers and has made Canada a leader in the global mining community.

They are:

1. **Canada's geological endowment**, which Dr. Murray Duke of the Geological Survey of Canada will discuss next;
2. **Canada's attractive and stable business environment**;
3. **Canada's mining and mineral processing tradition**; and
4. **Canada's international presence.**

ATTRACTIVE AND STABLE BUSINESS ENVIRONMENT

Canada's Economic Situation

While attractive geology, which Canada possesses and Dr. Murray Duke will discuss, is a necessity, it is not by itself a guaranty for a strong and vibrant mining sector. A strong mining sector also requires an attractive and stable business environment.

In fact, given the cyclical nature of the industry, and the large capital costs and long-lead times required to bring a mine into production, long-term stability is of particular importance to this industry.

The Canadian economy is, today, quite vibrant. Canada's fiscal situation is looking very good. A budget surplus was announced for 1997/98 fiscal year, and a second surplus will be announced by the Minister of Finance, tomorrow, for the fiscal year 1998/99. The government has also committed itself to a balanced budget or surplus for the fiscal year 1999-2000. For the first time in almost 50 years the federal government will have balanced its books for three years in a row.

Provincial and territorial governments, in part following the lead of the federal government, are also reducing their deficits.

A lower collective deficit has enabled the Bank of Canada to relax monetary conditions which have led to stronger economic growth. Real gross domestic product (GDP) growth in 1997 was

3.8%. In its December Economic Outlook, the Organization for Economic Cooperation and Development (OECD) projects that the Canadian economy will out perform all other G-7 economies with a GDP growth rate of 2.4% in 1999 and 2.9% in 2000.

Inflation, which peaked in January 1991 at 6.8%, has, on an annual basis, remained under 2.2% since 1992. Inflation in Canada is currently sitting at 1% (December 1998). A low inflationary environment has been established.

Low inflation, together with the progress made by all levels of government in Canada to restore fiscal balance, has resulted in a substantial decline in interest rates, with medium- and long-term interest rates near their lowest level in decades.

With export growth outpacing import growth, Canada's trade balance advanced $418 million to $1.9 billion in October. This represents the second highest surplus recorded so far this year.

With an economic slowdown predicted for the United States, Canadian exports are expected to grow more slowly in 1999 than in recent years.

Real Effective Exchange Rates, Major Zinc Producing Countries, 1991-98

Because metals are priced in U.S. dollars, currency fluctuations vis-à-vis the U.S. dollar are of particular interest to mining companies.

The strength of the U.S. dollar in the first half of 1998 was primarily a reflection of two factors. First, there was the strength of the U.S. economy, which had been expanding faster and operating at higher levels of capacity utilization than had previously been thought to be sustainable. The second factor was the attractiveness of the large, efficient and liquid U.S. financial market at a time when, because of uncertainties in Asia, nervous investors were looking for a safe haven.

While it is true that the Canadian dollar has declined vis-à-vis the U.S. dollar, the Canadian dollar has fared relatively well compared with the currencies of other major mineral producers.

Minor and/or short-term variations in exchange rates may increase or reduce pressures on a firm's bottom line. However, it will not affect a firm's long-term viability. On the other hand, large and longer-term increases against competitor countries, vis-à-vis the U.S. dollar, who produce the same commodity (after adjusting for inflationary differences), can seriously affect a firm's ability to compete on international markets.

This slide shows the real effective exchange rate indexes of the five major zinc producing countries of the world, from the first quarter of 1991 (indexed at 100) to the third quarter of 1998.

(While five countries are shown here, each country's index is computed using a basket of 13 zinc producing countries.) Each country's exchange rate is weighted by that country's relative importance in the world production of zinc. The index, thus calculated, shows the net effect of the two forces of inflation and exchange rate changes which can either offset or augment one another. A falling line indicates a gain in competitiveness for producers in the respective country.

Over the period shown, real effective exchange rate realignments have tended to have disparate impacts on competitiveness for the five zinc producing countries. Canadian producers have benefitted the most, while Peruvian and U.S. producers have seen a significant negative impact on their competitiveness based on real effective exchange rates. Australia has gained in the past year the competitiveness it had lost over the previous several years.

Mexican producers have seen a general rise in real effective exchange rates over the period, the rise broken only temporarily by the exchange crisis of December 1994 that saw the peso plunge massively and uncontrollably.

Like Canadian zinc producers, Canadian copper producers have also seen a gain in competitiveness relative to other countries. Chilean producers have lost dramatically. Australian and U.S. copper producers have generally gained in competitiveness since 1991 based on real effective exchange rates, but the United States has lost somewhat in the past year, as the dollar strengthened in the first half of 1998 against most currencies. Indonesia's real effective exchange rate plummeted in late 1997 as its currency fell during what is now known as the Asian crisis.

In the case of nickel, Canadian nickel producers have also generally gained in competitiveness based on real effective exchange rates over the period shown, although there has been a dramatic upwards turn in the index since early 1997.

Indeed there has been an upwards turn in the real effective indexes of all the major nickel producers except Indonesia, whose dramatic currency devaluations in 1997 affected other producers' indexes, given Indonesia's significant weight in the basket of nickel producers.

Key Features of Canada's Federal Income Tax Regime

Taxes are an important and unavoidable component of the business climate. Canada's tax regime is relatively stable, albeit complex, with different tax instruments being used by three levels of government: federal, provincial and territorial, and municipal.

Despite this reality, the Canadian federal corporate income tax regime offers a high degree of stability from three perspectives.

1. the current regime has not been fundamentally amended since the 1971 tax reforms, although periodically there have been incremental changes;

2. if changes were instituted, they were done after consultations where business and other key stakeholders had the opportunity to express their concerns and suggestions. Also, the Income Tax Act, in most cases, provided transitional measures to permit businesses time to adjust; and
3. the federal regime offers stability through consistency, since 7 out the 10 provinces have adopted the federal corporate income tax regime as their own. In these provinces, the declared corporate taxable income is the same on both the federal and provincial income tax forms. Even in the three provinces that have a separate corporate income tax administration, every effort is made to harmonize with the federal tax base.

In addition to stability, the current regimes recognize that not all businesses operate in the same environment and that business cycles do affect profitability. As a result, in order to encourage investment in private enterprise, the federal tax regime includes provisions of a general nature and, in some cases, provisions tailored to the uniqueness of resource specific industries. Often, the taxpayer has the flexibility to decide how best to exercise one's tax deductions.

As domestic savings are insufficient to meet domestic demand for investment, Canada is a net importer of capital. As a result, in part, the Canadian tax regime has been designed to attract capital and encourage international trade.

Canada also encourages companies to use Canada as a base for managing mining operations around the world.

Canada's Resource Industry-Specific Provisions

In the most simplest form, a corporation will pay taxes on its taxable income. Currently, a firm pays 29.12% of its taxable income as a tax to the federal government. Furthermore, in 7 out of 10 provinces, the corresponding provincial income tax will be a percentage of the same taxable income.

To accommodate the special needs and circumstances of the resource business, the calculation of taxable income has become more complex than would have been the case if uniform rules were applied to all sectors.

Because of the inherent complexity of Canada's tax calculations, we must be careful how we analyze the tax effects of a potential investment. I will elaborate on this cautionary statement later.

Now, let me cite a few examples of what could constitute a general deduction or a resource specific deduction.

The drafters of the current tax system wanted to ensure that the tax system generated revenues for the Treasury while encouraging continual investment into private enterprise. As a result, the calculation of taxable income was designed to take into account all valid deductions arising from normal business activities.

For instance, at a general level, the Canadian tax regime provides deductions for these activities in four areas.

1. Normal operating expenses (except depreciation) can be expensed for tax purposes immediately;
2. In lieu of depreciation, one may claim a capital cost allowance (CCA) deduction. The rules concerning CCA are complex and will not be discussed here. Essentially, they have been devised in order to approximate an asset's net economic residual value by the asset's book value less CCA deductions taken;
3. In order to encourage additional investment, debt interest payments are tax deductible thereby lowering the real cost of capital; and
4. Canada allows non-capital losses to be carried back three years or carried forward seven years. This provisions exists to ensure that taxes payable reflect the long-term profitability of a business and that it does not compromise its economic viability during temporary difficulties.

Finally, where possible, flexibility has been instilled into the system in order to permit taxpayers some freedom in claiming various deductions.

In addition to general provisions, the Canadian federal tax regime does recognize some of the unique risks inherent in the resource sector (including the mining sector). In aggregate, the government continues to encourage development of the mining industry throughout the entire mining life-cycle, including exploration, pre-production, production and, eventually, mine reclamation. Overall, these incentives generally decrease a mining firm's required cost of capital.

For instance, the resource allowance is a replacement for the deductibility of provincial mining royalties/taxes. It is calculated as 25% of a firm's resource income. Formerly, provincial mining royalties were deductible for federal income taxes (normal business expense). For base and precious metal producers, the amount actually deducted (as per this calculation) significantly exceeds the amount of mining royalties paid.

The Canadian Exploration Expense (CEE) permits a 100% deduction for exploration and pre-production expenses. Any unused balances can be carried forward indefinitely.

Canadian Development Expense (CDE) is a 30% declining balance write-off for expenses related to the development of a mine after the commencement of commercial production. Any unused balances can be carried forward.

Although most mining assets qualify for 25% CCA treatment, some assets, especially in a new mine/expansion are eligible for ACCA treatment at 100% deductibility. With CEE and ACCA, mining firms do not pay income taxes until all capital costs have been recovered.

Finally, mine reclamation activities are being implemented. In Canada, contributions to a mine reclamation trust are deductible as a current expense, if they have been mandated by a provincial authority.

Canada's International Tax Features

Canada understands the importance of and appreciates foreign investment. To attract investment, Canada has established tax treaties with other nations, ensuring a greater degree of stability. Tax treaties in general cover a range of tax issues and, often, contain provisions for bilateral foreign tax credits on foreign source income.

The treaties also secure the same benefits for foreign multi-national enterprises (MNE) as their Canadian counterparts.

As of January 1, 1999, Canada has established 70 tax treaties (65 in force and 5 signed not in force) with other countries and is aggressively in negotiation/re-negotiation to sign another 35.

In the case of MNEs, not all services are replicated in all jurisdictions. As a result, firms may institute charges for administrative and management services (ie. MIS, finance, marketing, etc…), product royalties and financial transactions. Often, transfer pricing is employed as a method to transfer these costs into the end products/services sold in the other jurisdiction.

However, in theory, transfer pricing could be exploited in order to shift costs from low tax rate jurisdictions to high tax jurisdictions. As a result, tax authorities are taking action to restrict the scope for cost and revenue shifting by MNEs. As far Canada is concerned, we are viewed as a "reasonable" jurisdiction.

Additionally, Canada is perceived as being more flexible than our American counterparts. Most of the perceived flexibility can be shown by examining the difference between the transfer pricing monitoring practices of Canada and United States. In the United States, transfer price monitoring remains a subjective exercise, limiting the overall flexibility conferred to the tax payer.

On the other hand, if the same business operated in Canada, it would have more flexibility to establish fair transfer prices, thanks to our objective criteria and rules concerning transfer pricing.

Canada is consistent with the rest of the international community in terms of its tax treatment of foreign source income and inbound investment. Canada remains competitive, thanks to our practices with respect to withholding taxes and thin capitalization rules[1].

---

[1] Thin capitalization rules have been designed to restrict a deduction for interest paid or payable by a corporation (resident in Canada) in a taxation year on debts owing to specified non-residents if the ratio of these debts to the corporation's equity exceeds three to one.

Let us consider four of them.

1. Our thin-cap rules are objective and not subjective as those in the United States;
2. Our system offers flexibility. Just consider that, for equity issues, foreign investors do not pay withholding taxes until all equity capital has been fully repatriated;
3. Even though Canadian firms pay income tax on global income, we ensure that they are not disadvantaged relative to their foreign based competitors via our withholding tax rules. Now, on the surface, our withholdings taxes appear to be high, 25%. However, if the non-resident is a resident of a country which has a tax treaty, as is often the case, the withholding tax rate is either eliminated or reduced to something in the range of 5% to 15%; and
4. We have no rigid capital controls limiting capital flows. As a result, investors in Canada are free to finance their projects with their own capital structures (financing arrangements), have easy access to foreign exchange markets and can move capital in and out of Canada without restrictions.

International Tax Burdens: Methods of Evaluation

As one can see, the Canadian tax system has multiple features that attempt to address the fact that not all firms are the same or are undertaking the same type of business activity.

Canada's tax regime tends to allow fast write-offs and other front-loaded investment incentives, thereby allowing for a relatively long initial tax-free period. The timing of tax payments is paramount to understanding how this tax structure affects a project's cash flow and returns. There is a value to the company of having tax payments deferred. This is important in a capital intensive and very cyclical industry such as mining.

The less appealing part of a front-loaded tax system such as Canada's is that it is partially offset by a relatively higher tax rate. As a result, Canada is seen as a high tax regime when statutory income tax rates are compared.

Even a comparison of marginal tax rates that incorporate the "permanent" deductions in a country's tax regime such as resource, processing, and/or depletion allowances, fails to capture all of the unique features of the Canadian corporate income tax system.

To truly evaluate a country's tax burden one must consider both permanent deductions and front-end tax incentives (tax deferrals, tax holidays, and tax credits), and look at their effects on the overall tax burden imposed on a project over its entire life. In what follows, I explain our tax

---

For instance, if you had a firm which had 80% debt held by foreigners and 20% equity, the interest payments exceeding 60% of the debt would not be deductible for corporate income tax. On the other hand, if the same firm had 25% equity and 75% debt owing to foreigners, it could deduct all the interest expense.

Overall, the strategy of the thin cap rules are to prevent mis-using the capital structure to transfer potential profits from Canada to other jurisdictions.

features by looking at the tax burden on an individual mining project.

Impact of Incentives on the Federal Income Tax Base

For example, in Ontario, assuming a project capable of generating a 10% internal rate of return, a mine may be sheltered from corporate income tax for the first seven years of production. This situation is made possible by the existence of generous and flexible depreciation and write-off rules that allow the deferral of any tax payment until capital costs are fully recovered.

It is also important to remember that these features, in most instances, also extend to provincial income taxes, as well as to provincial and territorial mining tax regimes. In Canada, provincial mining tax regimes are based on profits, and many also feature tax holidays for new mines, and automatic deductions which further reduce the tax base.

The pink, yellow and turquoise areas represent the portion of net revenue which is offset by depreciation, exploration and development costs and other deductions. The green area represents taxable income.

Obviously, the actual tax burden of a mine in a given jurisdiction (measured by the share of profit taken as taxes by governments) can vary greatly year to year due to a number of factors including: age of the mine (e.g., have front-end deductions been exhausted or not?), and profitability (did the mine turn out to be highly profitable?), etc.

Generally speaking, a company that is well established would rather have a lower tax rate than front-end incentives. On the other hand, a company that is in the process of bringing a mine into production will likely place a higher value on recovering its capital prior to paying taxes. A company`s preference depends on where it is in the life cycle of a mine, and the importance of that mine within the mine investment portfolio.

Relative Cost of Research and Development (R&D) Expenditures, 1995-96

Before leaving the subject of corporate income tax, I would like to briefly mention Canada's favourable tax treatment of R&D expenditures.

A recent study has shown that Canada's tax treatment of R&D expenditures is one of the most favourable among industrialized countries. Tax relief for R&D spending is provided by both the Federal Government and six provinces.

Large companies qualify for a federal R&D tax credit of 20% on eligible R&D expenditures, which can be used to reduce or eliminate federal tax otherwise payable. Small Canadian - controlled companies qualify for a federal R&D tax credit of 35% on up to $2 million of annual

R&D expenditures. The 35% tax credit on current expenditures may be fully refunded. All R&D expenditures can be written off over one year.

The tax credits are applicable to all eligible current and capital R&D expenditures. Buildings and used equipment do not earn tax credits.

This regime is substantially more favourable than the one in the United States, where a tax credit of 20% is available on incremental R&D expenditures only, and where capital expenditures are depreciated over five years and do not earn tax credits.

Environmental Regulations in Canada: Recent Developments

While a country's tax regime is obviously an important factor in determining the attractiveness of a country's investment climate, other factors, such a environmental regulations, can be equally important.

In Canada, responsibility for the management of the environment is shared between the federal government and the provinces. Both levels of government have, in recent years, revised their environmental regulatory regimes in response to environmental, social and economic concerns.

Federal and provincial governments are continuing to undertake broad regulatory reform initiatives aimed at improving the efficiency and effectiveness of environmental regulations affecting mining in Canada.

For instance, Canada's Ministers of Mines, in July 1997, launched the first ever federal-provincial-territorial cross-cutting review of mining and environmental regulations affecting mining in Canada.

This initiative involved key stakeholders, and federal, provincial and territorial mines, environment and fisheries ministers.

The results of the review, presented at the last Mines Ministers' Conference, July 1998, indicated a general agreement on the need to:

- maintain or improve environmental protection;
- clarify responsibilities and requirements; and
- improve communications, collaboration and cooperation within and between governments, and with key stakeholders.

Other important developments include:

1. the *Canada-wide Accord on Environmental Harmonization (the Canada-wide Accord)* signed by the Canadian Council of Environment Ministers (CCME) on January 29, 1998.

- The objective of the *Canada-wide Accord* is for governments to work in collaboration to protect the environment. Both levels of government retain their regulatory responsibilities;

2. Federal-Provincial Agreements to cooperate on environmental assessments.
   - These bilateral, and project-specific, agreements ensure that new development that projects are subjected to a single process that meets the requirement of both the federal and provincial governments;
3. the Federal Coordination Regulations and guidelines for panel review.
   - These guidelines impose time lines on various portions of the federal environmental assessment process, thereby increasing the predictability; and

In addition, there will be an efficient integration of science and policy-making in the recommendations for revision of the *Metal Mining Liquid Effluent Regulations*.

An efficient integration will result in a revision process that respects stakheholder consensus, is guided by the Government's policy in relation to minerals and metals, is consistent with the spirit of the Canada-Wide Accord on Environmental Harmonization, and is based on scientific evidence.

Finally, the *Fisheries Act* (FA) will be amended to replace authorizations with mandatory federal permits for projects with the potential to significantly harm fish habitat. This will provide greater certainty for project applicants. It will also ensure that all projects with the potential to significantly harm fish habitat are reviewed under both the FA and the Canadian Environmental Assessment Act.

Time to Complete the Environmental Assessments of Mining Projects in Canada

The greater harmonization of federal and provincial environmental regulations, and cooperation between the two levels of government have led to a significant decline in the number of months to complete environmental assessments of mining projects in Canada in recent years.

The graph shows mining projects that have recently completed the environmental assessment process in Canada. In the following chart the vertical axis represents time to complete an environmental assessment measured in months. On the horizontal axis is time from 1991 to 1996.

We expect this downward trend to continue as a result of additional regulatory improvements. We recognize the importance to investors of developing mining projects as rapidly as possible.

While it is true that the Canadian environmental assessment system is strict, it is not prohibitive. Deposits are being evaluated and mines are being developed. For instance, since 1989, 99 new mines have opened.

STRONG MINING AND MINERAL PROCESSING TRADITION

World Production Share and Ranking of Selected Commodities Produced in Canada, 1997

The opening of 99 new mines since 1989 has enabled Canada to maintain its standing as one of the world's largest producers of minerals.

Canada produces some 60 mineral commodities including 26 metals, 22 nonmetals (and diamonds were very recently added to this list) and five structural minerals.

Approximately 300 mines, 3000 stone/sand/gravel quarries, and some 50 nonferrous smelters, refineries and iron plants currently operate in Canada.

Canada is the world's largest producer of both potash and uranium. In 1997, Canada also ranked second in the production of asbestos, cobalt, nickel, magnesium, elemental sulphur, zinc and cadmium. Based on preliminary data, in 1998, Canadian nonfuel mineral production including coal was valued at more than $18.3 billion.

Canada's Mining and Minerals Expertise

One can not underestimate the human and financial effort required to bring a single mine into production, much less 99 in 10 years. And I should note that this figure does not include 70 mine reopening that were record over the same period.

To achieve this record, Canadian exploration and mining companies have had to develop unique exploration, and mining methods and technologies along with a risk-taking and aggressive prospecting attitude.

As Canada's exploration and mining sector expanded and matured over time, Canada's service sector incidental to exploration and mining has also grown. This sector, once limited to diamond drillers, geoscience and geophysical services, and base-camp logistical support providers, etc., has grown to incorporate less traditional mining equipment and services companies including legal, accounting, due diligence and financing companies that serve the mining community.

Canadians have pioneered the development of geophysical exploration techniques, be they ground or airborne. Canadian companies have captured 70% of the world market share for airborne geophysical equipment, while Canadian geophysical equipment manufacturers, related software developers and data interpretation companies hold about 60% of world markets.

Canadian mining companies are well on the way to creating the "intelligent mine" - one that can automatically detect changing conditions and respond quickly. In addition, more than 85% of the mining work force in Canada uses electronics, robotics and advanced telecommunication technologies.

Canada has also developed entire automated systems for mineral processing. Canadian technologies improve mine safety, enhance environmental systems, and increase productivity, allowing mining companies to explore deeper, richer ore bodies.

Canada's leading Ten Industries in Total Factor Productivity (TFP) Growth, 1984-95

The level of innovation and technological advances that are linked to Canada's mining and mineral sector, has made this sector one of the most productive in the Canadian economy.

According to a recent study by an independent agency, the leading industry in total factor productivity growth in Canada over the period 1984 to 1995 was the coal industry.

Productivity in our coal industry grew at a staggering average annual compound rate of 9 percent from 1984 to 1995 and exceeded other sectors such as electrical products and telecommunications.

Productivity increases are essential to controlling costs and maintaining the industry's competitive position in international markets. The success or competitiveness of Canada's mining industry is largely determined by productivity, input prices and exchange rates. Input prices (e.g., wages) and exchange rates are difficult for the industry to control. Therefore, improvement in productivity is the key factor in strengthening the industry's position relative to its major competitors.

Three of the ten leading industries in total productivity growth over the past decade were part of the mining industry - coal mines, non-metal mines and metal mines.

Productivity growth in our mining industry has dwarfed productivity growth in manufacturing and the total economy.

Mining's strong productivity growth is truly outstanding given that stricter health and safety, and environmental regulations over time tend to lower productivity growth.

In other words, our mining industry has become more efficient while improving working conditions and protecting the environment.

The reasons for the strong productivity growth in Canada's mining industry since the early 1980s are twofold.

1. improvements have occurred in the quality of labour. Current miners have greater knowledge, experience, skills and education than their predecessors. Canada's mining industry flourishes because of a highly skilled and productive work force; and
2. significant technological advances have occurred in all aspects of our mining industry from exploration to the protection of the environment.

[Exploration innovations include airborne geophysics, global positioning systems (GPS) and geochemical techniques. Geochemical exploration techniques were certainly instrumental in the discovery of Canada's diamond deposits - Ekati, Diavik and others.

Mining or extraction innovations include computer modeling and simulation techniques, mine design and entire automated mining systems.

Processing innovation include in-mine crushing, automated material handling, material characterization and liberation analysis.

Environmental innovations include environmental monitoring, rehabilitation design and waste disposal design.]

Strong productivity growth in all aspects of mining in Canada has allowed Canada to remain competitive in international base and precious metal markets, and a world leader in mineral production.

I should also note that these achievements have not been limited to just traditional mining and mineral-related services.

Sources of Equity Financing for Mining Companies, 1997

Canada is the world leader in mine financing. In 1997, public companies raised $10.1 billion in equity around the world. Of this total, 47% was raised in Canada. Canadian companies raised twice the value of their nearest competitors in the United Kingdom and Australia.

As a result, a number of foreign companies have taken notice and listed on Canadian stock exchanges. Boliden, Normandy, Meridan, Philex, Samax Gold and TVX Gold are examples of companies, in the past two years, which have chosen to relocate to Canada to take advantage of our financing opportunities.

The benefits include:

1. good coverage of companies of all sizes by the 100 plus mining analysts in Canada - which frequently leads to higher valuation multiples;
2. more exposure to Canadian and the U.S. financial institutions;
3. more contact with both junior exploration and senior mining companies based in North America;
4. less onerous shareholder approval provisions on the issue of additional shares; and
5. access to the Multi-Jurisdictional Disclosure System (MJDS).

The MJDS is a reciprocal initiative between the Canadian Securities Administrators and the U.S. Securities Exchange Commission (SEC) to facilitate U.S.-Canadian cross-border securities offerings. Access to the MJDS system is beneficial as it allows access to the much larger U.S. capital markets using a Canadian prospectus, not generally subject to SEC review.

In effect, by listing on a Canadian exchange, a company can easily access U.S. capital markets.

The giants of global finance are also relocating to Canada to be closer to the action. Recently, Credit Suisse First Boston and Deutsche Morgan Grenfell moved their respective international headquarters for mining finance to Toronto.

Exploration Expenditures in Canada, 1990-98

Access to capital, and Canada's varied and superb geology has given rise to two types of exploration companies in Canada - junior exploration companies and senior companies.

In Canada, a junior company is defined as a company that receives no income from a producing mine, in other words, it is a pure exploration company. Junior companies raise money through the stock exchanges or the private placement of shares in order to undertake exploration activities.

Junior exploration companies, which tend to be more aggressive than senior companies, are an important part of Canada's mining tradition. Canadian junior companies such as Dia Met Minerals Ltd. (Lac de Gras, diamonds) or Diamond Fields Resources Inc., (Voisey's Bay, nickel-copper-cobalt) have been responsible for a number of significant mineral discoveries in Canada.

Despite their smaller size and their financial constraints, the juniors account for close to 40% of all exploration expenditures in Canada and are a very dynamic and successful part of the Canadian exploration sector.

This slide depicts exploration expenditures in Canada over the period 1990-98. I have chosen this period to show you how strongly exploration spending recovered after reaching an historic low in 1992.

In fact, after recording a low of $413 million in 1992, exploration expenditures increased steadily until 1996 to reach $899 million. They then settled back somewhat to $804 million in 1997 and are forecasted to have reached $764 million in 1998. Although exploration spending has declined over the last two years, I would say that, despite the current low metal prices, these figures point to a quite strong exploration sector in Canada.

The relatively higher expenditures since 1992 have been driven principally by important discoveries of diamond deposits in Canada's north and by the late-1994 nickel-cobalt-copper discovery at Voisey's Bay in Labrador.

CANADA'S INTERNATIONAL PRESENCE

Canada's Proportion of Worldwide Budgeted Exploration Expenditures, 1993-97

Canada's mining industry, supported by a strong domestic base (geological endowment of Canada, a stable economic environment, and an established mining tradition), has had the strength and fortitude of mind (willing to take the risk) to go international.

At the end of 1998, companies of all sizes listed on Canadian stock exchanges held interests in a portfolio of more than 6800 exploration or producing properties located in Canada (3500) or elsewhere around the world (3300).

Large Canadian companies now control approximately one-third, a dominant share, of planned exploration expenditures around the world. This is up from around 22% in 1992. They now account for approximately (1998):

- 48% of large company exploration in Europe;
- 46% of large company exploration in the United States;
- 38% of large company exploration in Latin America;
- 23% of large company exploration in Africa-Middle East; and
- 9% of large company exploration in Asia-Pacific.

Canadian Participation in Major Development Projects Worldwide

As one can see from this map, Canadian companies are involved in projects around the world.

I should note, that many of these projects are being undertaken in cooperation with third country companies - including Japanese companies.

Copper:

1)	La Granja	Cu	Peru	Cambior
2)	Augu Rica	Cu/Au	Argentina	Northern Orion
3)	Cerro Colorado	Cu	Panama	Tiomin Resources Inc.
4)	Tenke Fungurume	Cu	Zaire	Tenke Mining Corp.
5)	Antamina	Cu/Zn	Peru	Rio Algom, Teck Corp., Noranda Inc.
6)	El Pachon	Cu	Argentina	Cambior
7)	Petaquilla	Cu	Panama	Adrian Resources Ltd., Inmet, Teck
8)	Cerro Casale	Cu/Au	Chile	Placer Dome, Bema Gold
9)	Santo Tomas	Cu	Mexico	Exall Resources Ltd., Britannia Gold Corp.
10)	Prosperity	Cu/Au	Canada	Taseko Mines Ltd.

Gold

1)	Pascua	Au	Chile	Barrick Gold Corp
2)	Las Cristinas	Au	Venezuela	Placer Dome
3)	Pierina	Au	Peru	Barrick Gold Corp
4)	Bulyanhulu	Au	Tanzania	Sutton Resources Ltd.

Gold (Cont'd)

5)	Vasilkovskoye	Au	Kazakhstan	Teck Corporation
6)	Skouries	Au	Greece	TVX Gold Inc
7)	Casino	Au/Cu	Canada	Pacific Sentinel Gold Corp.

Nickel

1)	Goro	Ni	New Caledonia	Inco Ltd.
2)	Voisey's Bay	Ni	Canada	Inco Ltd.
3)	Barro Alto	Ni	Brazil	Inco Ltd.
4)	Kabanga/Kagera	Ni	Tanzania	Sutton Resources Ltd.
5)	Loma de Niaquel	Ni	Venezuela	Jordex Resources
6)	Maggie Hays/Lake Johnston	Ni	Australia	LionOre Mining International Ltd.
7)	Emily Ann	Ni	Australia	LionOre Mining International Ltd.

Zinc

1)	Crandon	Zn	United States	Rio Algom Ltd.
2)	Cirque	Zn	Canada	Cominco, Teck
3)	Izok Lake	Zn	Canada	Kit Resources Ltd
4)	QDS (Qiandongshen)	Zn	China	Asia Minerals Corp.
5)	Kassandra	Zn/Au	Greece	TVX Gold Inc
6)	Kudz Ze Kayah	Zn	Canada	Cominco Limited
7)	Pend Oreille	Zn	Canada	Inmet Mining Corp.

Canada's Share of Western World Metal Production, Forecast 2002

Canada's international presence is not just limited to exploration properties. Canadian companies have producing operations throughout the world.

This slide compares Canada's expected share of world production in the year 2002, based on mine location and mine-ownership (production was allocated to each country based on the nationality of the companies owning the mine, and their percentage interest in it) for copper, nickel and zinc. Based on mine ownership Canada's share of world production of copper increases from 5.4% to nearly 12%.

The difference in the share of nickel production by mine ownership compared with mine location is also substantial. In the year 2002, Canada's share of world production based on mine ownership is expected to be over 35%, compared with about 22% based on domestic production. A good part of the difference in Canada's share internationally is due to Inco's presence in Indonesia.

As with copper and nickel, Canada's share of expected zinc production in the year 2002 is larger when calculated based on mine ownership rather than on mine location. Canadian companies should be producing about 33% of the world's output of zinc by the year 2002, compared to Canada's domestic share of about 21%. Much of this difference is due to the huge Red Dog mine in Alaska in which Canadian-based Cominco Ltd. has a major stake.

The international presence of Canadian exploration and mining companies means that Canadian companies are involved in most of the world's major discovery plays. This lowers production costs and benefits investors through higher earnings. Because Canadian companies are almost everywhere, they are the beneficiaries of both commodity and country risk diversification.

CONCLUSION

As I have tried to show today, Canada international competitiveness in mining and minerals is based on four main factors:

1. Canada has been blessed with a **varied and rich geology**;
2. Canada has a **stable and attractive business environment** that supports mining and mining-related industries;
3. Canada's mining sector, supported by a superior mining-related equipment and services sector, has developed world-class exploration and mining techniques - **a strong mining tradition**; and
4. The ability and willingness of Canadian companies to explore for, and develop, mines anywhere in the world, in other words, **Canada's international presence**.

Mining and Minerals: Canada's Competitive Advantage

Dr. Dale L. Hull
Director, Economic Analysis Division,
Minerals and Metals Sector, Natural Resources Canada
Tokyo, February 1999

Mining and Minerals: Canada's Competitive Advantage

- Canada's Geological Endowment
- Attractive and Stable Business Environment
- Strong Mining and Mineral Processing Tradition
- Canada's International Presence

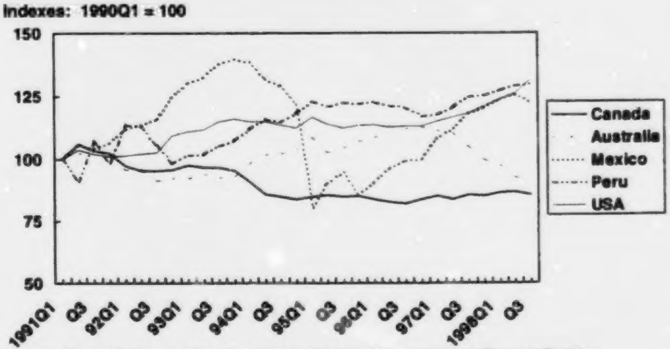
Canada's Economic Situation

- Low Inflation Rate
- Low Interest Rates
- Economic Growth
- Balanced Federal Budget
- Positive Trade Balance
- Undervalued Currency

Natural Resources Canada Ressources naturelles Canada

Canada

Real Effective Exchange Rates for Major Zinc-Producing Countries, 1991-98



Source: Natural Resources Canada, based on data from IMF *International Financial Statistics* and World Bureau of Metal Statistics.
Note: Q = quarter.

Natural Resources Canada Ressources naturelles Canada

Canada

Key Features of Canada's Federal Income Tax Regime

- Stability
  - Fundamentally Unchanged since 1971
  - Consultations and Transitional Measures
  - Basis for the Provincial/Territorial Income Tax Regimes
- Flexible Deductions
  - General Provisions
  - Resource Industry-Specific Incentives

Natural Resources Canada Ressources naturelles Canada Canada

Canada's Resource Industry-Specific Provisions

- Resource Allowance
- Canadian Exploration Expense (CEE)
- Canadian Development Expense (CDE)
- Accelerated Capital Cost Allowance (ACCA)
- Reclamation Expenses

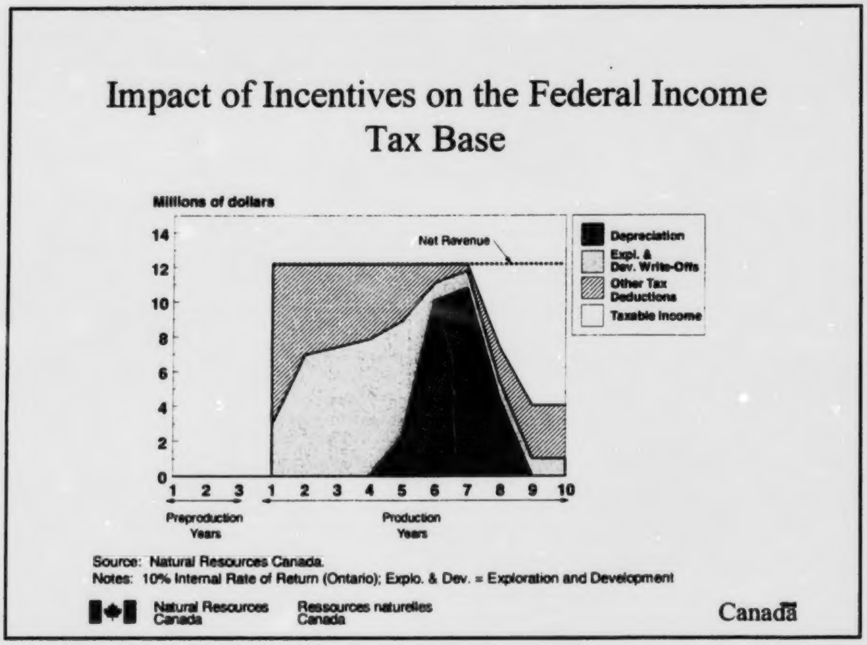
Natural Resources Canada Ressources naturelles Canada Canada

Canada's International Tax Features

- Tax Treaties
- Transfer Pricing Practices
- Income Tax Implications
  - Foreign Source Income
  - Dividends and Inbound Investment

International Tax Burdens: Methods of Evaluation

- Statutory Tax Rates
- Marginal Tax Rates
  - Adjusted for Permanent Deductions
- Average Effective Tax Rates
  - Time Value of Front-End Incentives

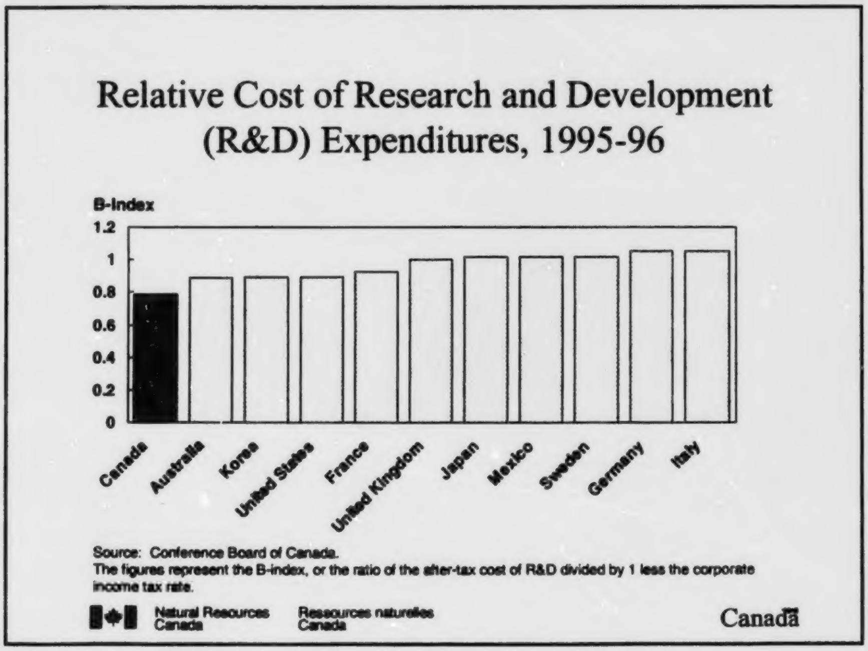


Impact of Incentives on the Federal Income Tax Base

Source: Natural Resources Canada.
Notes: 10% Internal Rate of Return (Ontario); Explo. & Dev. = Exploration and Development

Natural Resources Canada Ressources naturelles Canada

Canada



Relative Cost of Research and Development (R&D) Expenditures, 1995-96

Source: Conference Board of Canada.
The figures represent the B-index, or the ratio of the after-tax cost of R&D divided by 1 less the corporate income tax rate.

Natural Resources Canada Ressources naturelles Canada

Canada

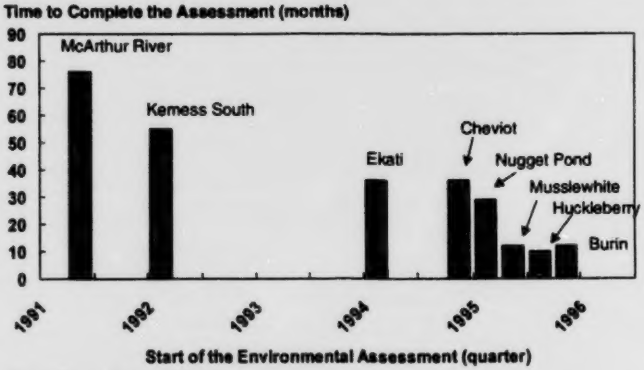
Environmental Regulations in Canada: Recent Developments

- *Canada-Wide Accord on Environmental Harmonization*
- Federal-Provincial Agreements to Cooperate on Environmental Assessments
- *Federal Coordination Regulation* and Guidelines for Panel Reviews

Natural Resources Canada Ressources naturelles Canada

Canada

Time to Complete the Environmental Assessments of Mining Projects in Canada

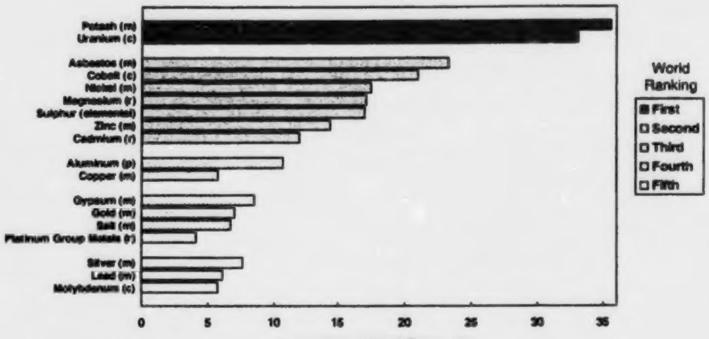


Source: Natural Resources Canada.

Natural Resources Canada Ressources naturelles Canada

Canada

World Production Share and Ranking of Selected Commodities Produced in Canada, 1997



Source: Natural Resources Canada

Notes: m = mine; r= refined; c = metal in concentrate; p = primary

Natural Resources Canada Ressources naturelles Canada

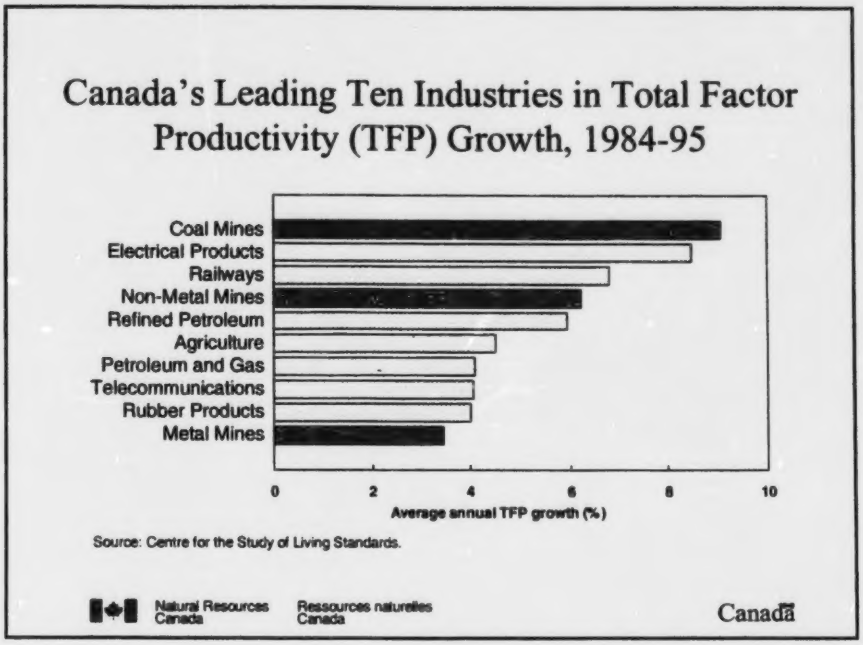
Canada

Canada's Mining and Minerals Expertise

- Exploration Financing
- Investment Analysis
- Due Diligence
- Legal Services
- Geophysics
- Geology
- Geochemistry
- Mapping
- Remote Sensing
- Drilling
- Communications
- Analytical Laboratories
- Feasibility Studies
- Engineering
- Project Management
- Mine Construction
- Parts and Equipment
- Mineral Processing
- Refining
- Smelting
- Automation and Software
- Environmental Management

Natural Resources Canada Ressources naturelles Canada

Canada

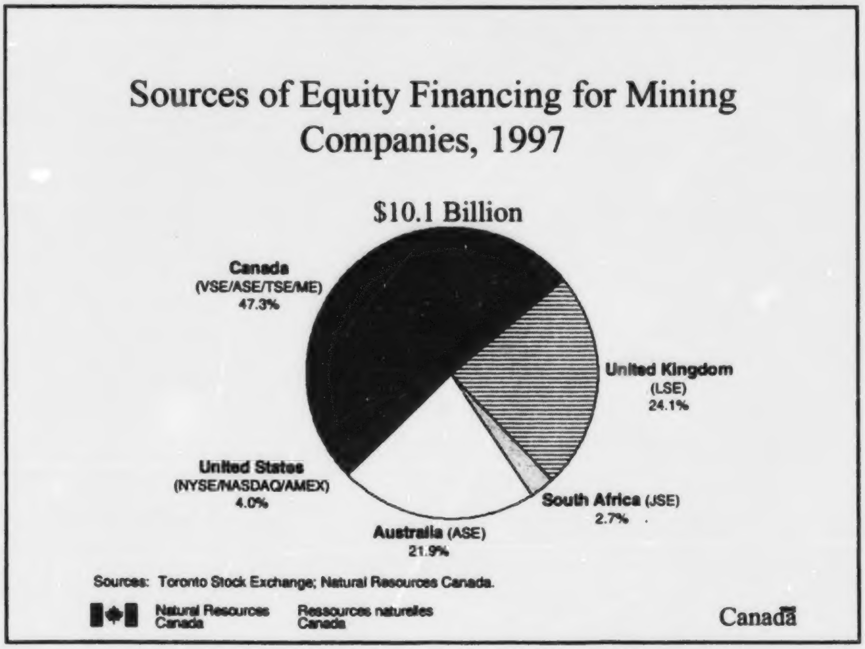


Canada's Leading Ten Industries in Total Factor Productivity (TFP) Growth, 1984-95

Source: Centre for the Study of Living Standards.

Natural Resources Canada Ressources naturelles Canada

Canada

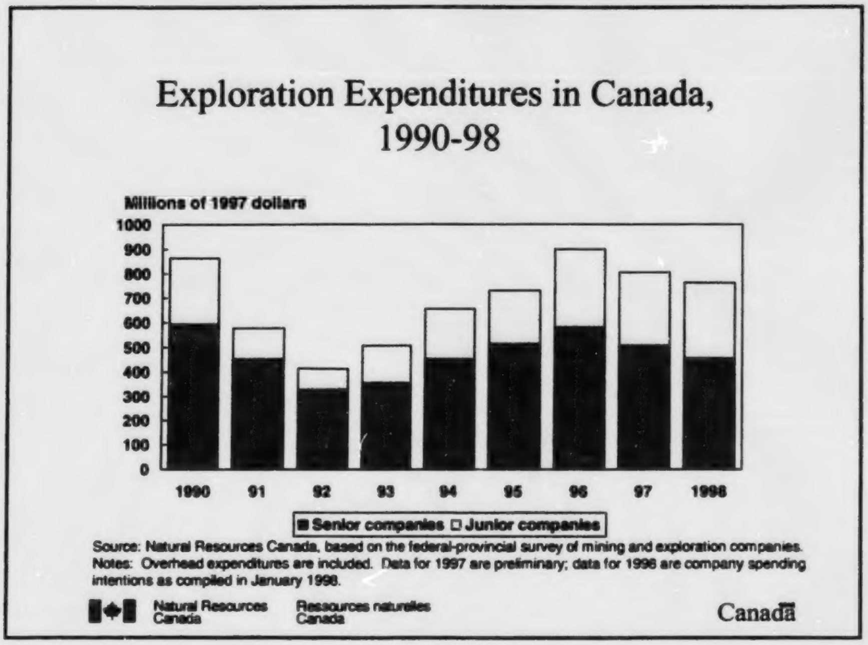


Sources of Equity Financing for Mining Companies, 1997

Sources: Toronto Stock Exchange; Natural Resources Canada.

Natural Resources Canada Ressources naturelles Canada

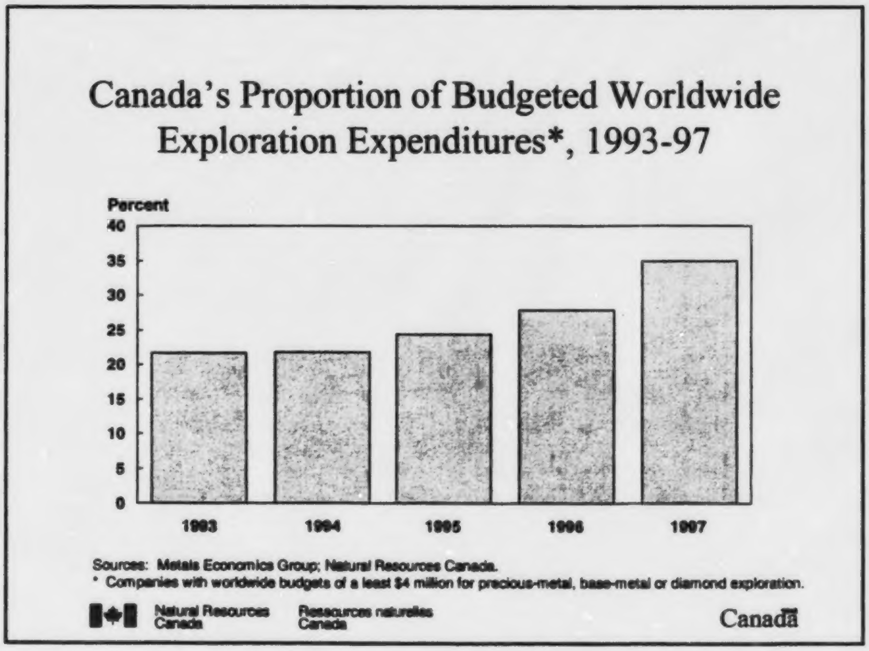
Canada



Exploration Expenditures in Canada, 1990-98

Source: Natural Resources Canada, based on the federal-provincial survey of mining and exploration companies.
Notes: Overhead expenditures are included. Data for 1997 are preliminary; data for 1998 are company spending intentions as compiled in January 1998.

Natural Resources Canada Ressources naturelles Canada Canada

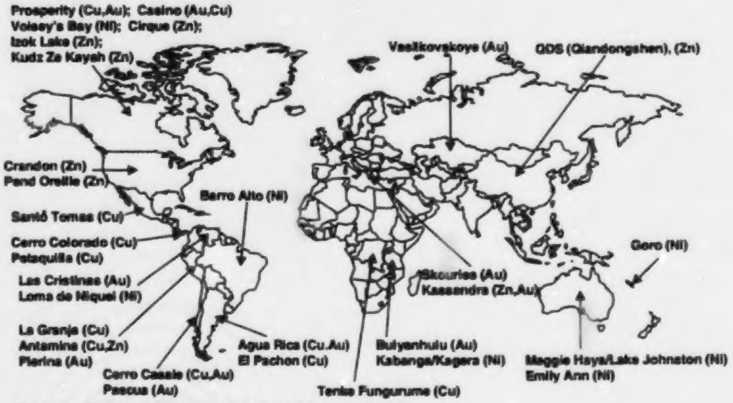


Canada's Proportion of Budgeted Worldwide Exploration Expenditures*, 1993-97

Sources: Metals Economics Group; Natural Resources Canada.
* Companies with worldwide budgets of a least $4 million for precious-metal, base-metal or diamond exploration.

Natural Resources Canada Ressources naturelles Canada Canada

Canadian Participation in Major Development Projects Worldwide

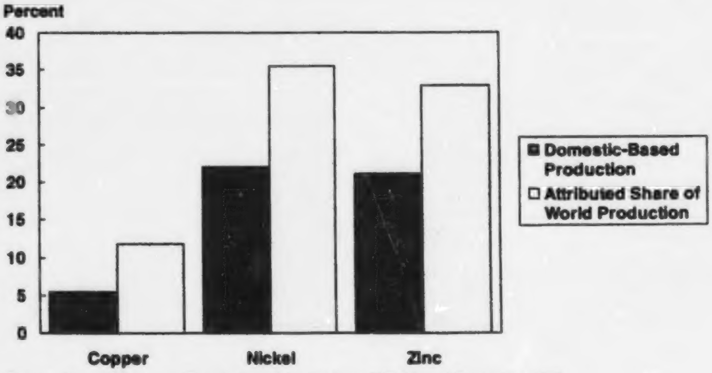

Prosperity (Cu,Au); Casino (Au,Cu)
Voisey's Bay (Ni); Cirque (Zn);
Izok Lake (Zn);
Kudz Ze Kayah (Zn)
Vasilkovskoye (Au)
QDS (Qiandongshan), (Zn)
Crandon (Zn)
Pend Oreille (Zn)
Barro Alto (Ni)
Santo Tomas (Cu)
Cerro Colorado (Cu)
Petaquilla (Cu)
Las Cristinas (Au)
Loma de Niquel (Ni)
Goro (Ni)
Skouries (Au)
Kassandra (Zn,Au)
La Granja (Cu)
Antamina (Cu,Zn)
Pierina (Au)
Agua Rica (Cu,Au)
El Pachon (Cu)
Bulyanhulu (Au)
Kabanga/Kagera (Ni)
Maggie Hays/Lake Johnston (Ni)
Emily Ann (Ni)
Cerro Casale (Cu,Au)
Pascua (Au)
Tenke Fungurume (Cu)

Sources: AME Mineral Economics; Natural Resources Canada.

Natural Resources Canada Ressources naturelles Canada

Canada

Canada's Share of Western World Metal Production, Forecast for the Year 2002



Source: Natural Resources Canada, based on data from AME Mineral Economics, 1998.

Natural Resources Canada Ressources naturelles Canada

Canada

Canada's Potential for New Mineral Wealth

Dr. Murray Duke
Director General, Minerals and Regional Geoscience Branch
Geological Survey of Canada, Natural Resources Canada

CANADA: A WINDOW ON GLOBAL MINING
World-Class Technology and Investment Prospects
Canadian Embassy, Tokyo, Japan
February 16, 1999

Dr. Murray Duke

Director General
Minerals and Regional Geoscience Branch
Geological Survey of Canada

Murray is a native of Montreal, Québec, Canada and commenced his university education in geology at McGill University in that city. He went on to earn his PhD at the University of Connecticut, followed by post-doctoral research at the University of Toronto.
Murray joined the Geological Survey of Canada (GSC) in 1976 to work on mineral deposits, focusing on nickel, chromium and platinum. He was subsequently appointed Director of the Mineral Resources Division in 1988, and then Director General, Minerals and Regional Geoscience Branch in 1995, the position that he continues to hold. Among his many and varied scientific and management duties in this role is responsibility for the GSC's Minerals Program to ensure that related research continues to address the current and evolving needs of Canada's minerals industry.

Dr. Duke has also served in various executive offices of the Mineralogical Association of Canada, culminating with his election to president in 1989 and 1990, and he was recently awarded the MAC Leonard G Berry medal for his significant contributions to that association. He is an associate editor of the journal *Economic Geology*, a member of the Management Committee, CAMIRO Exploration Technology Division, and a member of the IUGS/UNESCO Deposit Modeling Program.

Canada's Potential for New Mineral Wealth

Introduction

Exploitation of mineral resources is almost unique among industrial activities in the degree to which location is determined by Mother Nature. Political, social and economic considerations play a critical role in investment decisions, but mineral endowment is the fundamental factor which attracts mining exploration and development. This morning, I would like to give you a geologist's perspective of the potential for the discovery of new mineral resources in Canada and offer some thoughts on the intellectual capital that will be required to turn this potential into reality.

Mineral Potential

Mineral resource potential may be defined simply as the probability that undiscovered, exploitable mineral deposits are present in a given portion of the Earth's crust **(Fig. 1)**. Evaluation of mineral potential lies at the heart of exploration strategies used by industry and influence land use and economic development policies of governments. Notwithstanding its importance, the assessment of mineral potential remains an inexact and highly subjective

Our estimation of mineral potential is influenced by both intrinsic and extrinsic factors **(Fig. 2)**. The intrinsic factors relate primarily to geological attributes. Thus, to a first approximation, a country's mineral potential is proportional to its land area. It is further enhanced by favourable geology and by the presence of know mineral deposits. Th likelihood that the deposit will be discovered and exploited, on the other hand, may be more dependent upon extrinsic factors such as political stability, the investment climate, and the presence of suitable infrastructure.

Canada's intrinsic mineral potential is as great as virtually any country on Earth. In terms of land area, Canada ranks second only to Russia. Moreover, the Canadian landmass is underlain by diverse and highly prospective geology.

The principal geological provinces which make up the Canadian landmass are shown in **Figure 3**. The Canadian Shield, which accounts for 70% of Canada's metallic mineral production, is by far the largest Precambrian shield in the world. The greenstone belts which lie within the southern Shield have attracted the attention of prospectors in search of massive base metal sulphide and lode gold deposits for more than 70 years. Notwithstanding this previous exploration, there remain substantial expanses of greenstone in the more remote areas of the Shield which have received only cursory examination. The Shield is also the repository of Canada's world-class nickel, uranium and diamond deposits.

Atlantic Canada contains a significant portion of the Appalachian-Caledonian-Hercynian mountain belt which has been the source of much of the mineral wealth of the eastern United States and western Europe. Although much of the Canadian Appalachians has been relatively well-explored, there remains significant potential for several types of mineral deposits including volcanic- and sediment-hosted base metals and gold, and a variety of industrial minerals.

Western Canada contains a major segment of the resource-rich Cordillera which stretches southward from Alaska, through the United States, Mexico, Central and South America. The Cordillera is richly-endowed with porphyry copper, sediment-hosted lead-zinc, volcano genic massive sulphides, precious metal lodes and placers, and skarn deposits. Much of the Cordillera is difficult of access and areas of northern British Columbia and Yukon, in particular, are little explored.

The sedimentary basins of the Canadian Prairies and Arctic Islands are best known as our principal source of fossil fuels and potash. However, these basins also have good potential for lead-zinc deposits of the "Mississippi Valley Type" such as those at Pine Point and Polaris and, although no economic diamond deposits have yet been discovered on the Prairies, there is good potential.

Exploration and Discovery

This superior geological potential has been an important factor in placing Canada among the world leaders in terms of exploration expenditures over at least the last 25 years. Exploration is an inherently cyclical business in terms of both total expenditures and the commodities sought. Each wave of exploration spending has been reflected by significant discoveries as the focus shifted from base metals to uranium to gold, and recently, to diamonds. The amounts spent on exploration for base metals, precious metals and diamonds since 1975 are illustrated in **Figure 4**.

The decrease in exploration for base metals from about 1984 was mirrored by a significant decline in base metal reserves, as illustrated by the specific case of copper in **Figure 5**. After reaching a 25 year low in 1993, base metal exploration began to rebound in response to improving prices. In the meantime, base metal reserves seem to have at least stabilized and there have been a number of significant discoveries, including the world class nickel-copper deposit at Voisey's Bay in Labrador.

Spurred by significant price increases in the early 1970s, gold exploration increased dramatically reaching a peak in the heyday of flow-through shares in 1987. Although absolute spending levels have subsequently declined, gold exploration continues to outpace base metals in terms of expenditures. The other observation I would like to make here is the way in which the level of gold reserves parallels the amount spent on gold exploration.

Although there has been exploration for diamonds in Canada since at least 1960, the level of effort was relatively insignificant. All that changed when diamond-bearing kimberlites were found in Saskatchewan in 1988 and, in particular, the stunning discovery at Lac de Gras in the Northwest Territories in 1991. Diamonds now account for a significant proportion of total annual exploration expenditures in Canada. I will say more about diamonds later.

Canada has ranked among the top the countries in the world in terms of exploration expenditure since at least 1970. However, this does not mean that Canada has been over-explored. For example, **Figure 6** shows exploration expenditures on a unit area basis for Australia, South Africa, Canada and the U.S. during the 1970s and 1980s. You can see that the intensity of exploration in Canada over this time frame has been somewhat lower than in thee other jurisdictions, and there remain vast areas, particularly in northern Canada than have been little explored.

Knowledge Infrastructure

I spoke earlier of the intrinsic and extrinsic factors which influence mineral potential, and I have argued that Canada's intrinsic potential is probably as great as any country on Earth. Among the extrinsic factors which influence the probability that deposits will be discovered and exploited is the presence of suitable infrastructure. We normally think of infrastructure in terms of roads, power lines, and other physical installations. However, of equal or greater importance from the standpoint of the discovery or ore deposits is the knowledge infrastructure for exploration. I would like to devote the balance of my remarks this morning to an examination of the three cornerstones of this knowledge infrastructure: the regional geoscience knowledge base, mineral deposit models and exploration technology.

The quality and quantity of geological, and geophysical, geochemical data pertaining to Canada are impressive. However, by virtue of the country's immense landmass and small population, there remain large areas which have been mapped only at reconnaissance studies. To date, only 65% of the Canadian landmass has been mapped to modern standards at scales of 1:250,000 or larger and ongoing work continues to reveal favorable new districts.

Developments in the Finlayson Lake belt in southern Yukon provide a recent example **(Fig. 7)**. The Kudz Ze Kayah massive sulphide deposit was discovered in 1994 by Cominco Ltd. which had been attracted to the area by the results of a government geochemical survey.. This was followed by the other discoveries including the Wolverine and Wolf deposits by Atna Resources. Moreover, geological mapping has shown that similar rocks occur in the adjacent part of northern British Columbia. Although the economic viability of these deposits has not yet been demonstrated, this is potentially an important new base metal district. However, there are even more exciting possibilities. The Yukon-Tanana terrane occurs at what was the western margin of the North American continent at the end of the Paleozoic Period, some 200 million years ago. A major new NATMAP[1] project beginning this year will attempt to delineate these prospective rocks along the entire 2000 km length of this ancient continental

---

[1] NATMAP is Canada's national geological mapping program which is a cooperative effort on the part of the Geological Survey of Canada, the provincial and territorial geological surveys, academia and industry.

Another area of relatively untapped potential occurs along the western margin of the Canadian Shield where it is covered by a thin veneer of younger sedimentary rocks, in places only a few tens or perhaps a hundred metres thick. This means that the buried rocks of the Canadian Shield are accessible.

Recently, geologists working in the Flin Flon area of Manitoba and Saskatchewan have been able, for the first time, to map the Precambrian bedrock surface underneath the younger cover rocks. One of the most exciting results from the standpoint of mineral potential is that the rocks of the Snow Lake and Flin Flon domains may be traced for some considerable distance beneath this cover. Extending this approach all along the Shield margin would open up large areas of

Mineral deposits are sometimes discovered as a result on new understanding of the nature and origin of a particular deposit type which, in turn, causes geologists to look at old ground from a new perspective. This is especially true for gold deposits as there are many different types and these can occur in diverse geological environments. We have recently published a global classification of gold deposits based on geological parameters. The many different styles of gold deposits are may be grouped into the three clans based on the depth in the Earth's crust at which the deposits formed **(Fig. 8)**. Deposits of the quartz-carbonate-vein clan forms at depths of 5 to 10 kilometres, the porphyry-related clan reflects formation at depths of perhaps 1 to 5 kilometres , whereas the epithermal clan forms at or near the Earth's surface.

Quartz vein deposits have been the main source of Canadian gold production for much of this century. This may be because they are relatively abundant and easier to discover because of the obvious contrast with their host rocks. In any case, this quartz vein model guided exploration in the Canadian Shield for much of this century.

Perceptions began to change in 1981 when the giant Hemlo deposit was discovered in Ontario, literally underneath the Trans Canada Highway. Gold at Hemlo is subtly disseminated along with sulphide mineral in volcanic and sedimentary rocks. We now know that Hemlo belongs to the porphyry clan which are form at intermediate levels in the Earth's crust. This has profoundly changed the approach to gold exploration in the Canadian Shield. Although porphyry-related and epithermal gold deposits were prime exploration targets in younger terranes, particularly in the circum Pacific region, conventional wisdom held that they were not present in old, deformed Precambrian terranes.

There are more world class gold deposits, that is, deposits containing more than 100 tonnes of gold, in Precambrian Shield rocks of Archean age than in rocks of any other period. Canada has the world's largest expanse of Archean Shield and, as I have tried to argue, new deposit models are allowing geologists to explore this vast region with fresh eyes.

Archean areas are also favourable the occurrence of another mineral commodity - diamonds. The discovery of diamonds in Canada's Northwest Territories in 1991 is a vivid example of the impact of enhanced exploration technology. Diamonds form at depths of several hundred kilometers and are brought to the Earth's surface by volcanic activity, most commonly in rocks called kimberlites. The typical kimberlite pipe is a small, carrot shaped-body about a kilometre or less in diameter and extending to depths of perhaps 2 to 3 kilometres. It had been known for a long time that productive kimberlite hosted diamond deposits are virtually restricted to areas underlain by very old continental crust, shown in **Figure 9**. Although it was evident that Canada, with the world's greatest expanse of Archean rocks, had a high geological potential for diamonds, exploration up until the late 1980s had been limited and inconclusive. One reason for this was the fact that most of Canada was subjected to glaciated during the Pleistocene Period and kimberlite, being an inherently soft material was preferentially eroded and left covered with glacial sediment. The breakthrough in 1991 resulted from an improved understanding of diamond indicator minerals and of the dispersal of these minerals by glaciers.

Diamonds occur in such low concentrations in kimberlites that one would have to be extremely lucky to observe one in a small sample. However, other more abundant minerals which are characteristic of diamondiferous kimberlites may be used as pathfinders. In other words, in the early stages of exploration, one searches for these indicator minerals rather than the diamonds themselves. The second critical step was to understand the directions in which the glacier ice moved. Armed with this information, the exploration strategy is deceptively simple. Once regional reconnaissance surveys have turned up indicator minerals in the glacial sediments, follow these in the direction from which the ice flowed until no more are found. At this point, geophysics may is used to outline the precise location of the kimberlite pipe. This approach has turned up more than 70 pipes in the Lac de Gras field.

The rest, as they say, is history. Production began at the Ekati Mine in October 1998. Production is expected to reach a level of 4 to 5 million carats per year, with an average value of $85 to $90 US per carat, and with reserves sufficient to sustain production for 20 to 25 years. This was a remarkable achievement - from discovery to production in seven years. A second diamond mine, the Diavik project, which is expected to come on stream in 2002.

Much of my talk so far has focused on the mineral potential of some of the less explored areas of Canada. I would now like to say a few words about the potential of new approaches to exploration to find new reserves in mature mining districts. The Bathurst camp of New Brunswick is one of our most important base metal districts, accounting for 32% of Canada's zinc production and 44% of lead.

Figure 10 shows how recent geological mapping has changed the understanding of one part of the Bathurst district. The large area mapped as “felsic volcanics” on the 1977 map would not have been considered to have high potential. In contrast, the 1997 map shows alternating bands of volcanic rocks, and we know that the contact between these units is the favourable horizon for ore deposits in this district.

Airborne electromagnetic surveying has been a mainstay of base metal exploration in Canada for more than 30 years. The first discovery by an airborne EM system was in fact made in the

Bathurst Camp in 1954. This technology has come a long way in the meantime, and many of the areas which were surveyed in the past should be re-surveyed with the enhanced methods. This was done in 1996, and an example of the resulting high-resolution conductivity data is shown in **Figure 11**. This survey resulted almost immediately in the discovery of the Camelback massive sulphide deposit. Although it has not yet proven to be a commercially exploitable deposit, the important point is that the improved technology has resulted in many new exploration targets in the camp.

The key to finding new ore reserves in many of Canada's established mining camps will be the ability to discover more deeply buried deposits. One of the most exciting new developments in this area is in the application of seismic reflection methods to map ore-controlling structures to depths beyond the penetration of conventional geophysics. Although seismic methods have long been the mainstay of oil and gas exploration, until recently, they had not been successfully applied to mineral exploration in crystalline rocks such as those of the Canadian Shield. Take for example a recent case study in the important Matagami base metal camp in northwestern Quebec. All the known ore bodies occur at the contact of two volcanic units: the Wabassee basalts and the underlying Watson rhyolites. Conventional geophysical methods have been unable to follow this contact below depths of 300 metres. However, the seismic reflection profile shown in **Figure 12** clearly locates the contact to depths of more than 2500 metres.

Recent research at the Geological Survey of Canada has shown that direct detection of ore deposits is also possible with seismic reflection technology. Reflections occur when there is a large contrast between the density and acoustic velocity of two rock units, as is the case between typical ore minerals and host rocks. The actual output of a 3-dimensional seismic survey conducted over the Bell Allard deposit at Matagami is illustrated in **Figure 13**. This is a horizontal map view at a depth of 1000 metres. The distinct circular anomaly at the centre is a 6 million ton copper-zinc orebody. This technology is in its infancy but shows great promise for deep exploration of mature mining camps.

I have argued that Canada has great mineral potential and that one of the keys to unlocking this potential is the knowledge infrastructure upon which exploration is based. In Canada we are very proud of the quality and extent of our geoscience maps and data. Indeed, the industry has said that this knowledge base is one of the competitive advantages that Canada enjoys in attracting investment in mineral exploration. However, we recognize that to stay competitive, we must take advantage of the latest information technologies to get through this knowledge into the hands of the exploration community as quickly and effectively as possible. For this reason, the federal, provincial and territorial geological surveys in Canada have begun to develop the Canadian Geoscience Knowledge Network. Simply stated, the goal of this initiative is to use the Internet to provide exploration geologists with virtually instantaneous access the reports, maps and data they need, wherever in the world they may be based.

A first step in this initiative was the development of the Canadian Geoscience Publication Directory which allows the explorationist to use the Internet to find out what maps, reports and data are available for any part of Canada (**Figure 14**). After selecting a province or territory, one simply zooms into an area of interest, click on the types of publications sought, and click again to get the bibliographic references (**Figure 15**).

The province of British Columbia is at the cutting-edge of this new way of doing business. The British Columbia Geological Survey website called "The Map Place", illustrated in Figure 16, provides a wide array information. Not only can the exploration geologist see what information is available, he can download many maps and data directly from the Internet. The Map Place also has some innovative tools such as the Exploration Assistant, which allow the geologist to conduct basic GIS analysis to identify areas of estimated high potential for various minerals, add geochemical and other data layers, and even determine the status of mining claims.

Conclusion

I would like to leave you with three messages today. The first is that Canada's intrinsic mineral potential is as great as virtually any country in the world. The second message is that despite being one of the leading targets of mineral exploration over the last 30 years, there remain large parts of the country which are relatively unexplored. Finally, that one of the keys to turning unexploited potential into real assets is through continually enhancing and applying the knowledge infrastructure for exploration.

Mineral Resource Potential . . . . . .

the probability that exploitable mineral deposits occur within a given portion of the Earth's crust.

Figure 1.

Intrinsic Factors . . .

- Landmass Area
- Geology
- Known Mineral Deposits

Extrinsic Factors . . .

- Political
- Socio-economic
- Infrastructure

Figure 2.

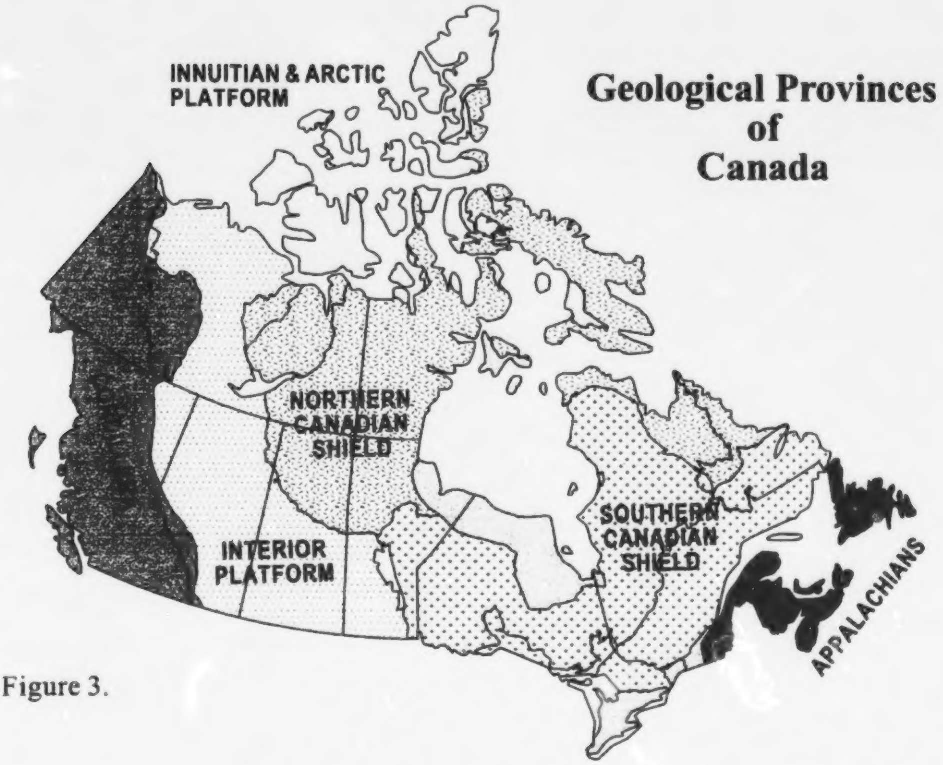

Geological Provinces of Canada
INNUITIAN & ARCTIC PLATFORM
NORTHERN CANADIAN SHIELD
INTERIOR PLATFORM
SOUTHERN CANADIAN SHIELD
APPALACHIANS

Figure 3.

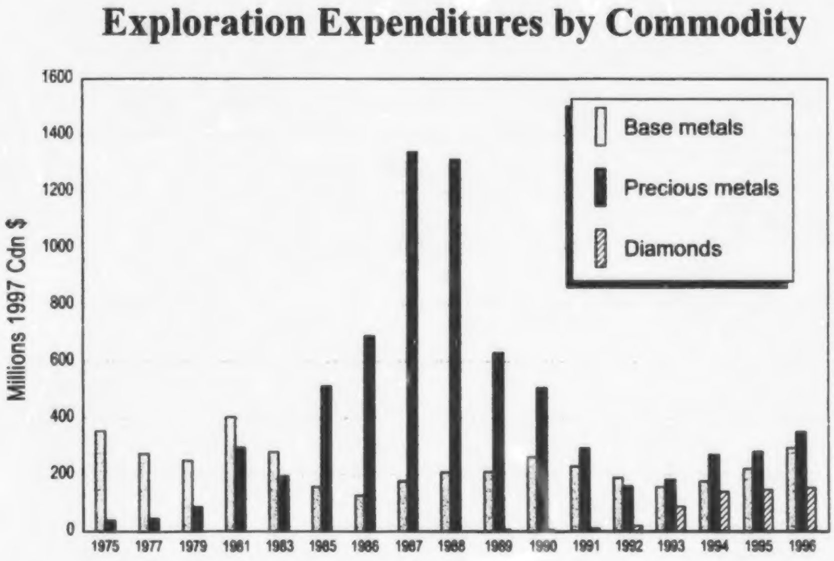


Figure 4.

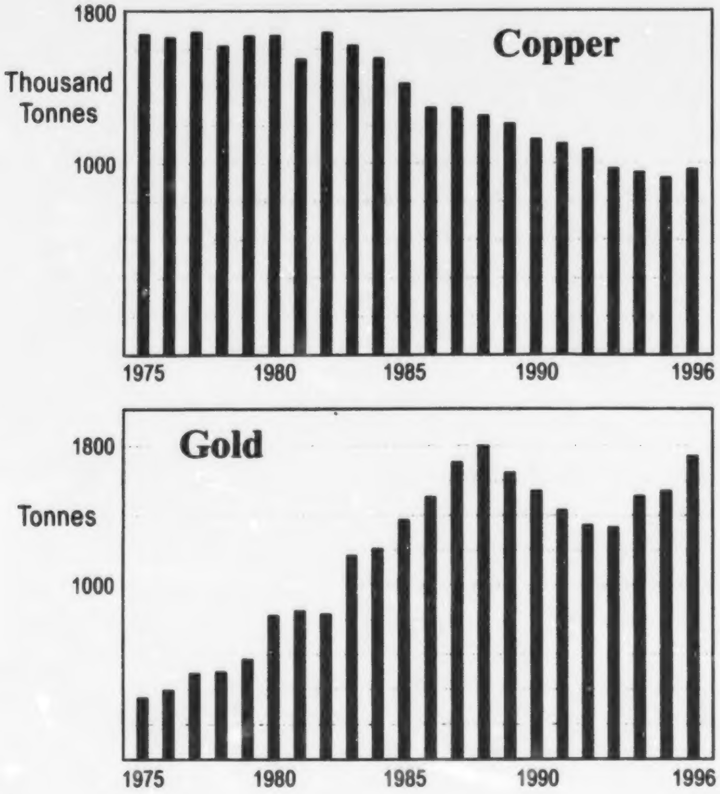


Figure 5.

Exploration Expenditures Per Unit Area

	1970 - 79	1980 - 89
Australia	$70	$103
South Africa	$70	$121 *
Canada	$56	$98
USA	$66	$57

(1990 Canadian dollars / square kilometre)
* 1980 - 83

Figure 6.

Yukon Tanana Terrane

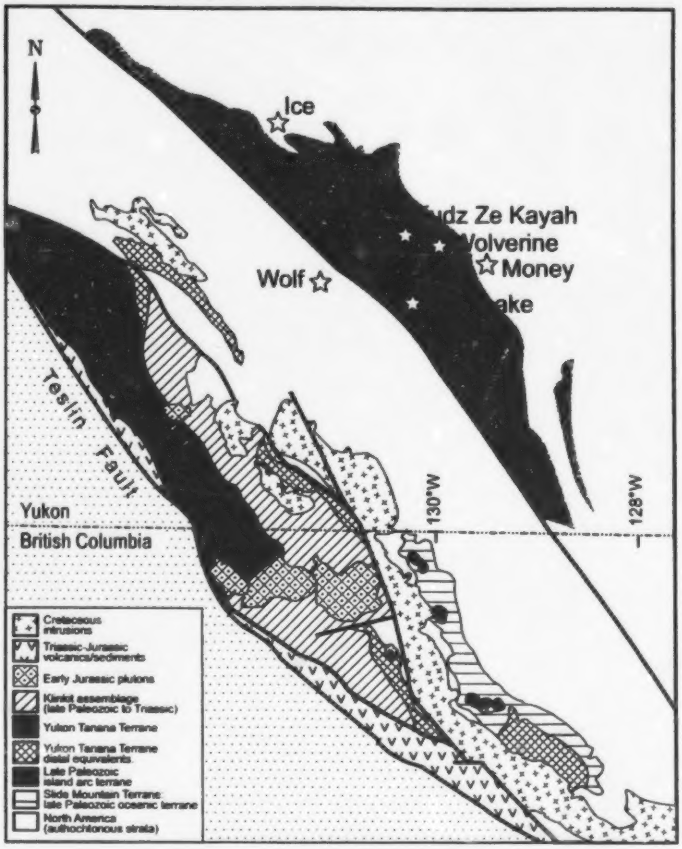

N
Ice
dz Ze Kayah
olverine
Money
Wolf
ake
Teslin Fault
Yukon
British Columbia
130°W
128°W
Cretaceous intrusions
Triassic-Jurassic volcanics/sediments
Early Jurassic plutons
Klinkit assemblage (late Paleozoic to Triassic)
Yukon Tanana Terrane
Yukon Tanana Terrane distal equivalents
Late Paleozoic island arc terrane
Slide Mountain Terrane: late Paleozoic oceanic terrane
North America (authochtonous strata)

Figure 7.

Inferred Crustal Levels of Gold Deposition

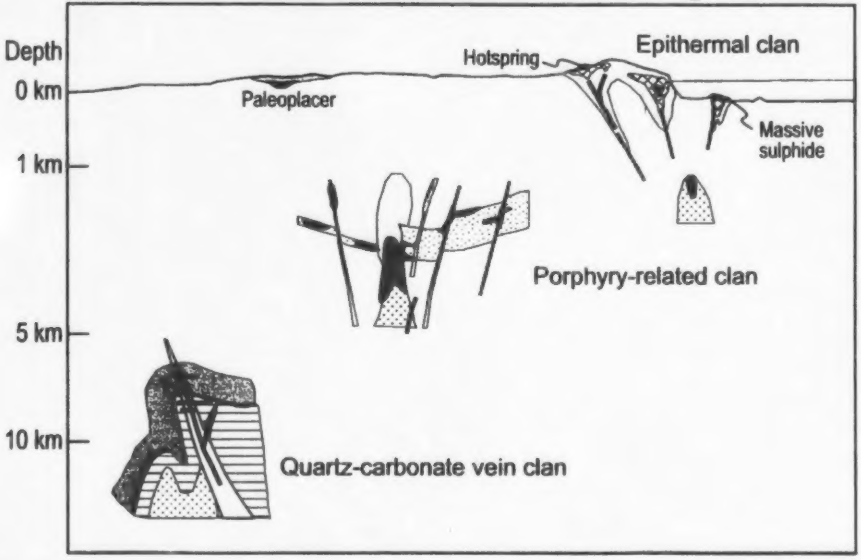
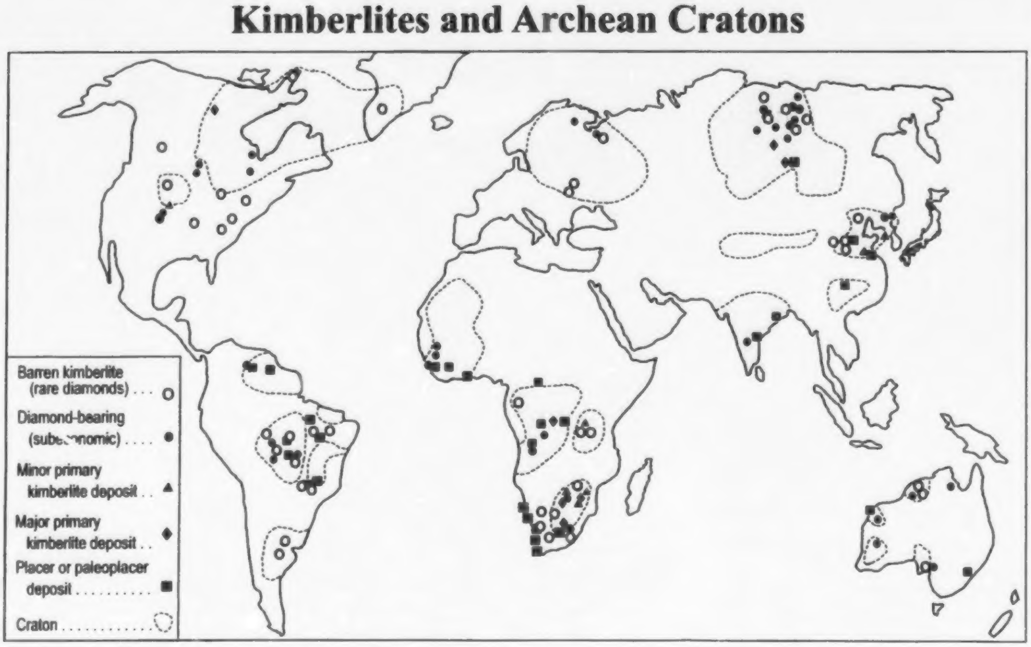
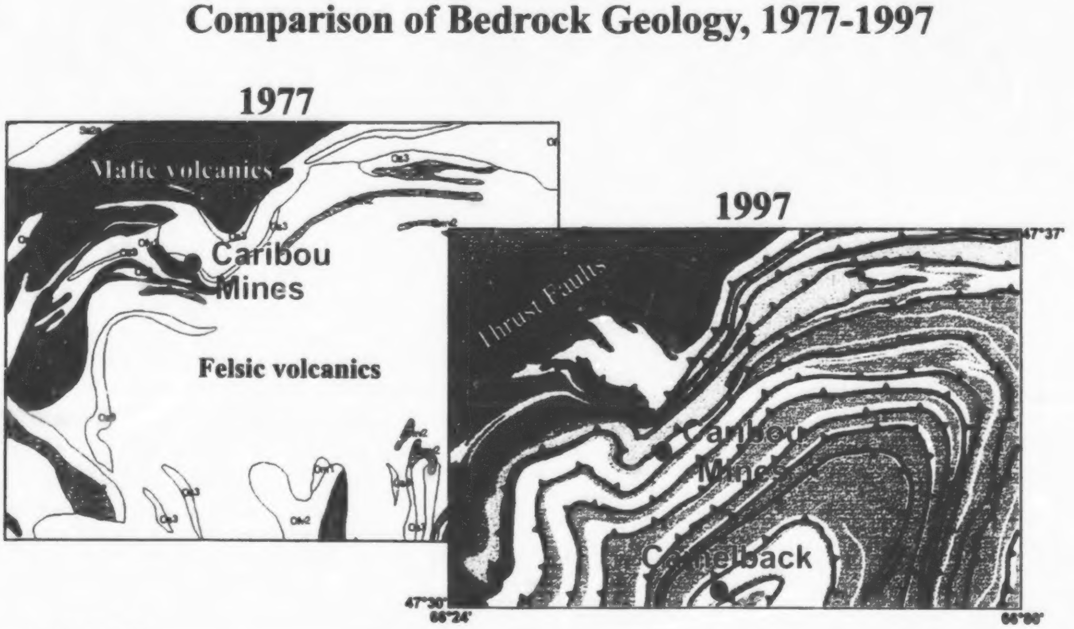

Depth
0 km
1 km
5 km
10 km
Paleoplacer
Hotspring
Epithermal clan
Massive sulphide
Porphyry-related clan
Quartz-carbonate vein clan

Figure 8.


Kimberlites and Archean Cratons

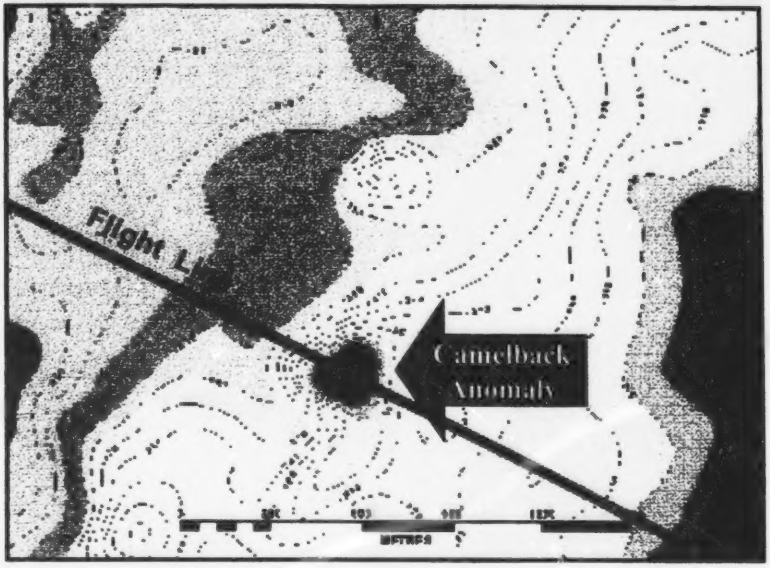
Barren kimberlite (rare diamonds) . . . ○
Diamond-bearing (subeconomic) . . . . ●
Minor primary kimberlite deposit . . ▲
Major primary kimberlite deposit . . ◆
Placer or paleoplacer deposit . . . . ■
Craton . . . .

Figure 9.


Comparison of Bedrock Geology, 1977-1997

1977
Mafic volcanics
Caribou Mines
Felsic volcanics
1997
47°37'
Thrust Faults
Caribou Mines
Camelback
47°30'
66°24'
66°00'

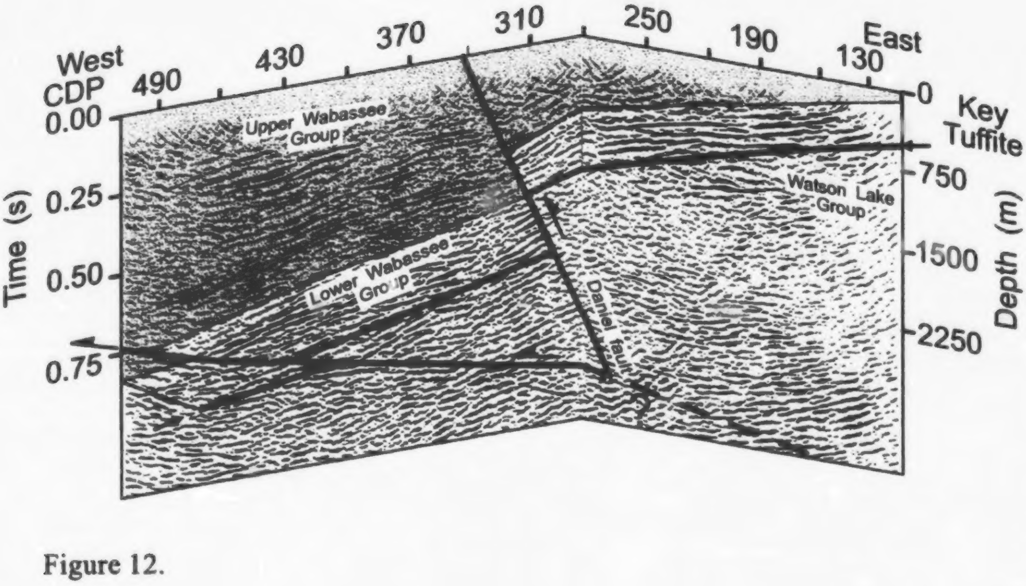
Figure 10.



Conductivity Anomaly, Camelback Deposit

Flight Line
Camelback Anomaly

Figure 11.



West
CDP
490
430
370
310
250
190
130
East
0.00
0.25
0.50
0.75
Time (s)
0
750
1500
2250
Depth (m)
Key Tuffite
Upper Wabassee Group
Lower Wabassee Group
Watson Lake Group
Daniel fault

Figure 12.

Three Dimensional Seismic Image

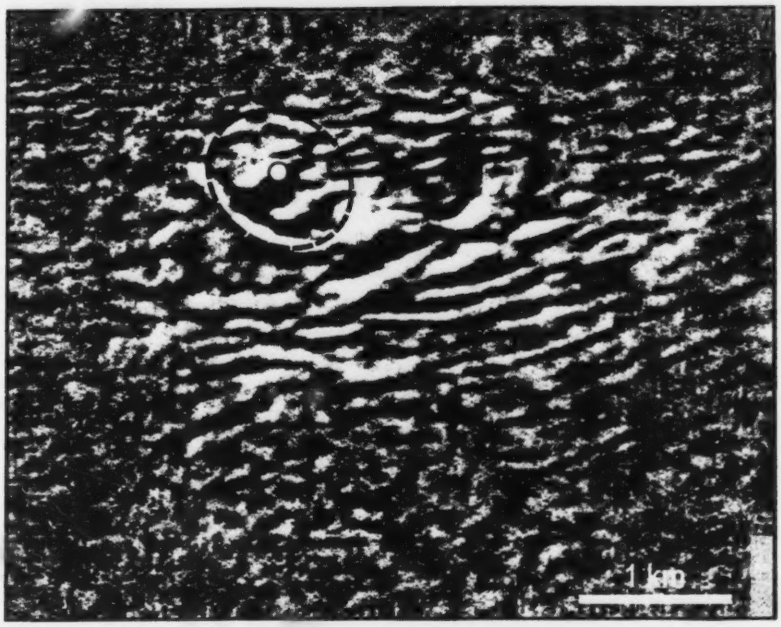


Figure 13.

Canadian Geoscience Publications Directory

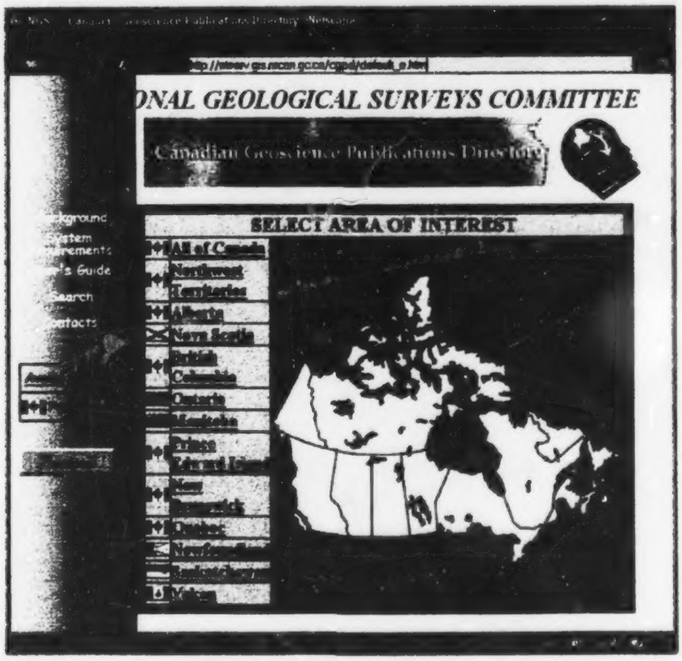

ONAL GEOLOGICAL SURVEYS COMMITTEE
Canadian Geoscience Publications Directory
SELECT AREA OF INTEREST
All of Canada
Northwest Territories
Alberta
Nova Scotia
British Columbia
Ontario
Manitoba
Prince Edward Island
New Brunswick
Quebec
ckground
System
irements
's Guide
Search
ntacts

Figure 14.

Canadian Geoscience Publications Directory

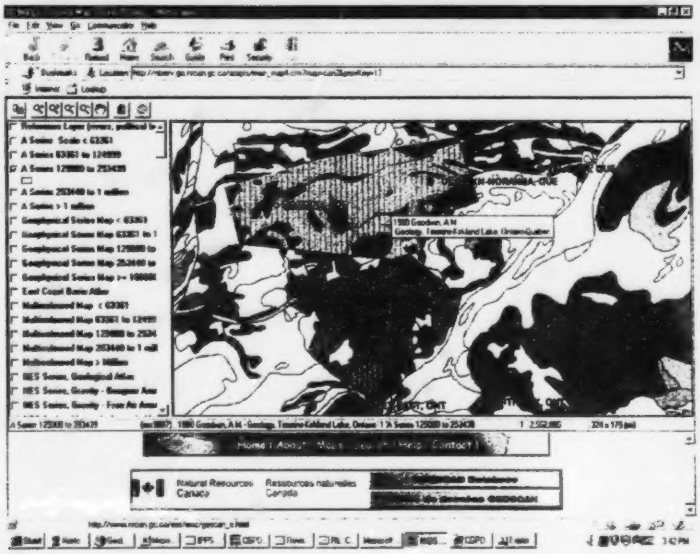

File Edit View Go Communicator Help
Back Reload Home Search Guide Print Security
Bookmarks Location
A Series 125000 to 253439
1980 Goodwin, A.M.
Home | About | Help | Contact
Natural Resources Canada
Ressources naturelles Canada

Figure 15.

THE MAP PLACE

Ministry of Employment and Investment
British Columbia, Canada

Geological Survey Branch

MAPS

An extensive Internet site that provides access and visualization of geoscience maps, data and imagery, as well as links to other B.C. government databases of interest to the resource exploration community.

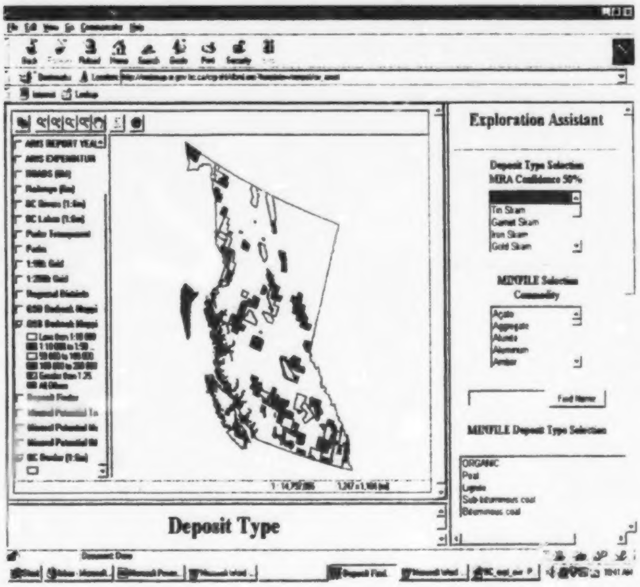

Exploration Assistant
Deposit Type Selection
MRA Confidence 50%
Tin Skarn
Garnet Skarn
Iron Skarn
Gold Skarn
MINFILE Selection
Commodity
Agate
Aggregate
Alunite
Aluminum
Amber
Find Name
MINFILE Deposit Type Selection
ORGANIC
Peat
Lignite
Sub-bituminous coal
Bituminous coal
Deposit Type
Document: Done

Figure 16.

ABORIGINAL ISSUES IN THE CANADIAN MINING INDUSTRY

by

Douglas B. Buchanan

Tokyo Mining Seminar
February 16, 1999

DAVIS & COMPANY
Barristers and Solicitors • Patent & Trademark Agents
Vancouver, Tokyo, Toronto, Montreal, Ottawa, Yellowknife, Whitehorse

Mr. Douglas B. Buchanan

Senior Partner
Davis & Company

Mr. Buchanan is the former Managing Partner of Davis & Company and is a senior partner in the firm's Banking Practice Group, Asia Practice Group and Natural Resource (forestry, mining and energy) Practice Group. He has extensive experience in international transactions generally and Japan related transactions in particular. The scope of his practise includes acting for Japanese corporations doing transactions in Canada, the United States, South East Asia and South America and acting for Canadian and U.S. clients doing transactions in Japan.

INTRODUCTION

To say that "aboriginal rights" in Canada, and their relevance to the development of natural resource projects, is a confusing issue is an understatement. The only thing that is clear is that this confusion has created a negative impression in the international business community about Canada as a place to invest.

In the short time I have today I will focus my comments on four areas:

- I will discuss the legal background to aboriginal issues and treaty settlement issues in Canada.
- I will give you a brief overview of "what is involved" from a legal perspective in dealing with aboriginal issues in the context of the development of a Canadian mining project.
- I will provide some general observations on these issues from the perspective of a law firm which has dealt with aboriginal matters for over 100 years. Our firm's perspective is from both sides of the fence so to speak. While we have acted for the developers or financiers of a great number of the natural resource projects in Western and Northern Canada, our firm has also acted for aboriginal groups in some of the landmark cases which initially established the concept of aboriginal rights in Canada, such as the Guerin case and Sparrow case, both of which we won in the Supreme Court of Canada.
- Finally and most important, I will tell you why, instead of being intimidated by and avoiding aboriginal issues, it is in your business interest to understand these issues and get involved with and "work" with the issues and the aboriginal people.

BACKGROUND TO ABORIGINAL ISSUES AND TREATY SETTLEMENT ISSUES

Legal Framework

The law in Canada on aboriginal rights and title, as it has judicially evolved, can be currently summarized as follows:

- The Federal Government or Provincial Government own the "underlying" title to all land, surface and subsurface, throughout Canada.
- As a result of historical use of the land, aboriginal groups have certain rights in respect of the land, including in some cases title. These rights represent an outstanding "burden" on the Governments' title to the lands until such time as the rights are extinguished or otherwise removed by the Federal Government.

- Aboriginal rights differ depending upon their degree of connection with the land. These rights range from traditional harvesting rights, to site specific rights unique to aboriginal culture or practices, to aboriginal title which is a right to the land itself (not fee simple but right to use, occupy and, possibly, exploit the land and resources).

- The historic mechanism used to address aboriginal rights and title and remove this burden from the Governments' title to the lands (dating back to the Royal Proclamation of 1763) is to enter into a treaty or settlement agreement whereby the aboriginal people "surrender" to the Federal Government their unique aboriginal interest in return for certain benefits.

- "Existing" treaty or aboriginal rights (which include aboriginal title) over the lands are recognized and affirmed under s.35 of the Canadian Constitution.

- Any human settlement or resource development which may interfere with aboriginal rights or title must be justified by the Governments "based on valid legislative objectives and consistent with the Crown's fiduciary obligations to the aboriginal people whose rights may be affected".

Status of Treaty Implementation

- Treaties were signed in parts of eastern Canada and throughout the western prairies during the 1800's and early 1900's.

- In British Columbia treaties covered the southern portion of Vancouver Island and the northeastern part of British Columbia, but otherwise aboriginal matters remain unsettled in British Columbia.

- The first contemporary treaty was the James Bay Agreement in 1976 entered into by the Federal Government, the Province of Quebec, Quebec Hydro and the James Bay Cree and Inuit of northern Quebec.

- In the Northwest Territories several comprehensive land claim settlements were concluded in the western region in the 1980's under the Federal Government's Comprehensive Claims Policy.

- In the Yukon, an umbrella comprehensive land claim settlement was concluded in early 1990's following which each aboriginal community in the Yukon would ratify their own individual settlements and self-government agreements according to the terms of the umbrella agreement. I believe there are 14 aboriginal groups in the Yukon, 6 of whom have signed agreements and eight are still being negotiated.

- The Nunavut Land Claim Agreement covers 25 million square kilometres of north-eastern Canada and contemplates not only a resolution of aboriginal issues but the establishment of a new territory and government of Nunavut. Other speakers at this seminar will give you more details on this region.

Substance of Treaties

- The early treaties involved a surrender of aboriginal title in exchange for for some land (reserves), harvesting rights and other tangible benefits.
- The contemporary treaties also involve a surrender or resolution of aboriginal title in return now for cash compensation, land (settlement lands and not necessarily reserve lands under the *Indian Act*), harvesting rights, resource sharing arrangements (in some cases), self-government agreements and other aboriginal specific benefits.
- In all the contemporary land claim agreements (treaties) mentioned above and in the highly publicised new Nisga'a Agreement in British Columbia, the settlement involves different categories of land:
    - Settlement lands over which the aboriginal people retain aboriginal title or have a communal fee simple interest in the land.
    - Traditional lands over which the aboriginal people can still exercise their harvesting rights (ie. hunting, fishing, trapping) or other cultural practices.
    - Other lands where the Crown has clear interest in the land unfettered by aboriginal title.

In summary, Canada is a "patchwork" of treaty lands, yet to be negotiated treaty lands and non treaty lands.

HOW DO YOU DEAL WITH ABORIGINAL MATTERS IN THE CONTEXT OF A PROJECT?

How does a natural resource company deal with the aboriginal issues in the context of the development of a project in Canada?

- Who you negotiate with depends, of course, on which lands the project is going to take place. If it is on "settlement lands" it will be with the aboriginal group. If it is on "traditional lands" which includes lands which might be the subject of a future treaty or settlement it will have to be with the aboriginal group, if their rights are going to be infringed, and the Federal, Provincial or Territorial Government. If it is on Government land not burdened with aboriginal rights or title, then negotiations are likely only with the appropriate Government.

- In a situation where you know a project is going to affect aboriginal rights, the Supreme Court of Canada has stated that a Federal or Provincial Government may interfere with aboriginal rights but such interference must meet a two pronged justification test:
    - The interference must be in furtherance of a valid legislative objective that is compelling and substantial. Mining, forestry development and other economic developments apparently meet this objective according to the Supreme Court of Canada.
    - Any interference by the Governments (ie. allowing a mining project to proceed) must be consistent with the Federal Government's fiduciary obligation to the aboriginal group who's rights are affected, in other words, the Government must be "fair" to the aboriginal group.
- The Government's fiduciary obligation to the aboriginal group has several components:
    - There must be adequate and meaningful consultation with the affected aboriginal group. The degree of consultation varies with the degree of interference with these rights. At a minimum it is "significantly deeper than mere consultation" and in some cases it may require the aboriginal group's consent. The aboriginal group must be provided with data and perhaps the expertise sufficient to enable them to make a reasonable assessment of the impact of any development in their traditional territory.
    - In most cases compensation is required because of the "inescapable economic aspect" of aboriginal rights. However, the amount of compensation will vary depending on the nature of the rights affected and the severity of the infringement.
    - Finally, some priority will be required to reduce economic barriers to participation by the aboriginal people in resource development and any permits, licences etc. granted must reflect this priority interest where it exists.
- In areas where you don't know if your project affects aboriginal rights or title, it is usually the responsibility of the Provincial authorities issuing any permits or licenses to:
    - Conduct an aboriginal rights impact assessment study or its equivalent.
    - Determine if any rights are going to be impacted.

  - Contact the aboriginal group's duly authorized and elected representatives about any potential infringement. Sometimes knowing who is duly authorized presents a problem.

- Once it has been concluded that a project affects aboriginal rights, the Government's obligation is then to conduct the necessary consultations, consider any compensation requirements and conclude, if appropriate, any "impact benefit agreement" with the aboriginal group to ensure the project proceeds. The form and content of "impact benefit agreements" (they have other names) and the issues involved in negotiating these agreements is itself a whole discussion area and beyond the amount of time I have available. I believe that other speakers at this seminar will talk more specifically about some of the issues and terms generally found in these kinds of agreements.

- While it is the Government's legal responsibility to complete the above steps, usually it is the resource company who conducts the steps in a more expedited fashion. In recent projects in which our firm has acted for the developer, BHP's diamond mine in the Northwest Territories and the Huckleberry copper mine in British Columbia, and in the recent Minto project in which we assisted the aboriginal group, it was the companies that initiated the dialogue with the aboriginal groups and brought along the Federal, Provincial or Territorial Governments in order to conclude a deal.

GENERAL OBSERVATIONS

As is usually the case, what seems simple in theory is often complicated in practise. Our law firm is involved on a daily basis dealing with aboriginal issues in the context of the forestry, mining, energy and other natural resource industries. The following are some general observations from our experience:

- In December 1997 the Supreme Court of Canada handed down a judgment commonly referred to as "Delgamuukw". This case was initially viewed as a major victory for aboriginal groups justifying their claim of ownership to their traditional lands, in fact, the press was suggesting that aboriginal groups owned all of Canada. This caused serious concern in the natural resource industries. However, it is simply not true that Delgamuukw decided that aboriginal groups "have aboriginal title to their traditional lands". The Supreme Court did hold that "aboriginal title" exists as a legal concept but said that the burden of proof of title is on the aboriginal group and until proven, no such title exists. To my knowledge to date no court in Canada has ever held that any particular aboriginal group had aboriginal title to any land anywhere in Canada.

- At work in Canada are a number of environmental or special interest groups. These special interest groups are able to maintain their existence to a large extent from public donations or funding. It is my experience that these groups approach every new natural resource project from the perspective of creating a role for themselves and using the project to create profile. In many cases it is the environmental angle (ie. the Windy Craggy Mine) but often it is the aboriginal angle (ie. Huckleberry, Daishowa/Lubicon). Their tactics are often extreme. I note in Friday's Vancouver newspaper that an aboriginal group is taking the British Columbia Government to court claiming "inadequate consultation" in connection with the Tulsequah Chief mine in Northern British Columbia but that the case is being funded and spearheaded by special interest groups. The clash of resource development visions and the battle for public opinion is always a major development issue. These groups are a fact of life and must be dealt with strategically by both the developer and the Governments.

- It is my experience that, as a general statement, aboriginal groups want resource development, want skills training for their young people and want the economic security that this brings. However, it is also my experience that, for many good reasons, aboriginal groups are extremely suspicious of government, business and the establishment in general. This suggests why the anti-business special interest groups currently have a stronger connection with aboriginal groups than the business community.

- When an aboriginal group opposes a project it is rare, in my experience, that they take the view they want it stopped unconditionally. They usually are not happy with some aspect of the project, not happy with the compensation provided, if any, or are using the project as a negotiation issue to achieve some larger objective, such as the manner in which the Lubicon Band used Daishowa's pulp project as a negotiation tool to try to obtain a treaty settlement.

- If an aboriginal group opposes a project, the legal attack is against the Federal Government or Provincial Government and the basis of "inadequate consultation" through the permitting process. It is rare but there have been a couple of occasions where a government permit has been set aside because of "inadequate consultation" with an aboriginal group.

- I have a high degree of confidence in the Governments' ability to successfully defend these attacks. Virtually every Government in Canada has revised its "consultation guidelines" in light of Delgamuukw and these guidelines should be adequate to prevent any successful attack on a project through the courts. In almost all instances we ask that our developer clients be made party to these court proceedings in order to both assist the Governments and make the court aware of the degree of reliance (ie. financing raised, equipment purchased etc.) that has been placed on the validity of the permitting procedure.

- While there have been a number of well publicized attempts by aboriginal groups directly against developers to stop projects or industrial activity on lands on which they were claiming they had aboriginal title, there has only been one case in the past decade where the court issued such an injunction, and that order was set aside two weeks later and the decision to set it aside was upheld on appeal.

WHY IS IT WORTH GETTING INVOLVED?

While aboriginal issues in Canada are complicated, I suggest that it is in your business interest to embrace them, understand them and open a line of communication with these aboriginal groups. Consider the following:

- In negotiating land claim settlements, aboriginal groups always retain significant geological expertise in determining which are the most mineral rich lands to have included within their settlement areas. As a result, aboriginal groups are the holders of significant mineral rights in Canada and want these developed for their benefit. For example, I understand that in Nunavut the aboriginal group holds 50% of the land area with the greatest mining potential.

- In areas where settlements haven't been made such as British Columbia, aboriginal groups as a general rule also want economic development. They simply cannot wait until the courts decide their aboriginal rights or a treaty is negotiated to improve the position of their people.

- Overcoming historical suspicion and mistrust and developing a good relationship with an aboriginal group has to be a key development strategy. If such a relationship is established, the company will have an inside track at other mineral developments which the aboriginal group may control. Also, word travels fast in the aboriginal communities and a good project with one aboriginal group can give a company an advantage in dealing with other aboriginal groups.

- Aboriginal groups can be your most effective political ally in dealing with the Government bureaucracy through the permitting stage. Conversely, you can almost be assured that a project will not be approved if there is significant aboriginal opposition.

- If as a strategy you are able to obtain the support of the aboriginal group early in a project, they can be your most effective public opinion ally in dealing with the environmental lobby or other special interest groups.

- Even if you are unable to bring obtain the aboriginal group's unqualified support, the downside is limited. The Delgamuukw case and the revised Government consultation guidelines, as well as the courts' predisposition to not shut down projects, have created a very significant degree of certainty that once your permit is issued, your project will be secure from successful attack.

In summary, deals are being done and relationships are being established with the aboriginal communities. I am told that in the last 10 years 99 new mines have been developed in Canada and a further 69 mines reopened. My advice to you is - don't consider Canada's aboriginal situation as an obstacle to investment, think of it as an opportunity for investment. Learn about the various aboriginal groups and the resources they control. Make an effort to educate the aboriginal groups about Japan, the Japanese people and the Japanese business world. I think you might find that they are "relationship" based business people much like the Japanese. The Japanese may have more in common with the aboriginal people than you would ever have thought.

That is an appropriate lead in to the next speaker, John Steele, who will talk to you about "how to find a good project in Canada". If you would like a copy of my speaking notes please talk to me at lunch or later in the day.

Finding a Project - Project Development Issues in Canada

Mr. John P. Steele
Director/Member of the Executive Committee
Prospectors and Developers Association of Canada (PDAC)
and
President
Iriana Resources Corporation

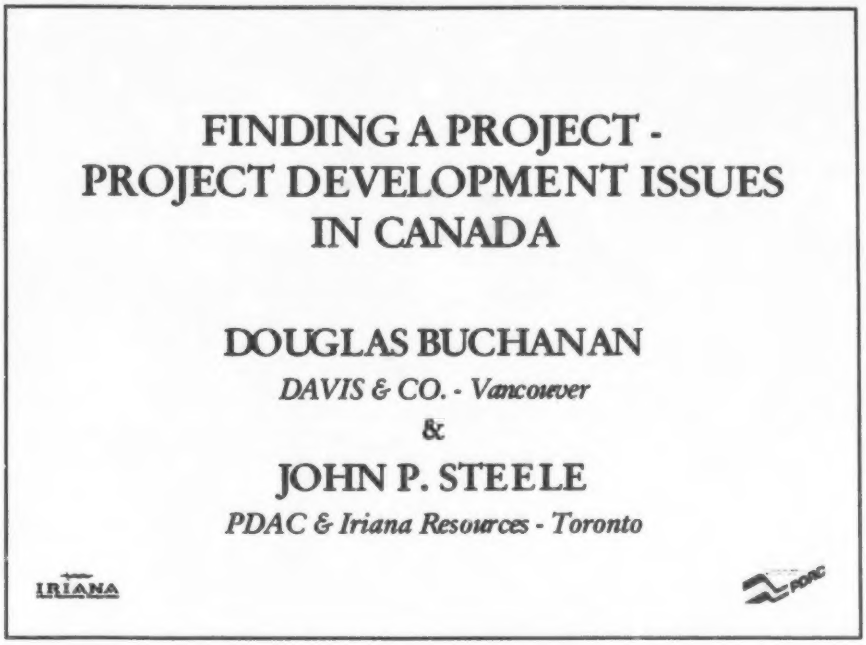
CANADA: A WINDOW ON GLOBAL MINING
World-Class Technology and Investment Prospects
Canadian Embassy, Tokyo, Japan
February 16, 1999

Mr. John P. Steele

President, C.E.O. and Director
Iriana Resources Corporation, Toronto

John Steele has an Msc in Geophysics from the University of Toronto and is a Professional Engineer in the Province of Ontario. From 1994 to 1996 he worked for Yorkton Securities Inc. in Toronto where he managed Yorkton's operations throughout Southeast Asia. Prior to that position he has occupied a number of positions of increasing responsibility within the mineral exploration industry both as a geophysical contractor and in staff positions within major mineral exploration companies. He has worked in all but one of the Provinces and Territories of Canada and in over 70 countries worldwide.

He is currently a director of several companies active in the natural resource sector including: High American Gold Inc.; Paron Resources Ltd.; Asian Tiger Resources Ltd; Geothai Services Company Ltd.; Iriana Resources Corporation; International Dunlap Minerals Corporation and The Vietnam Exploration and Development Corporation. He is also a director, convention committee Co-Chairman and member of the Executive Committee for the Prospectors and Developers Association of Canada.



FINDING A PROJECT - PROJECT DEVELOPMENT ISSUES IN CANADA

DOUGLAS BUCHANAN

DAVIS & CO. - Vancouver

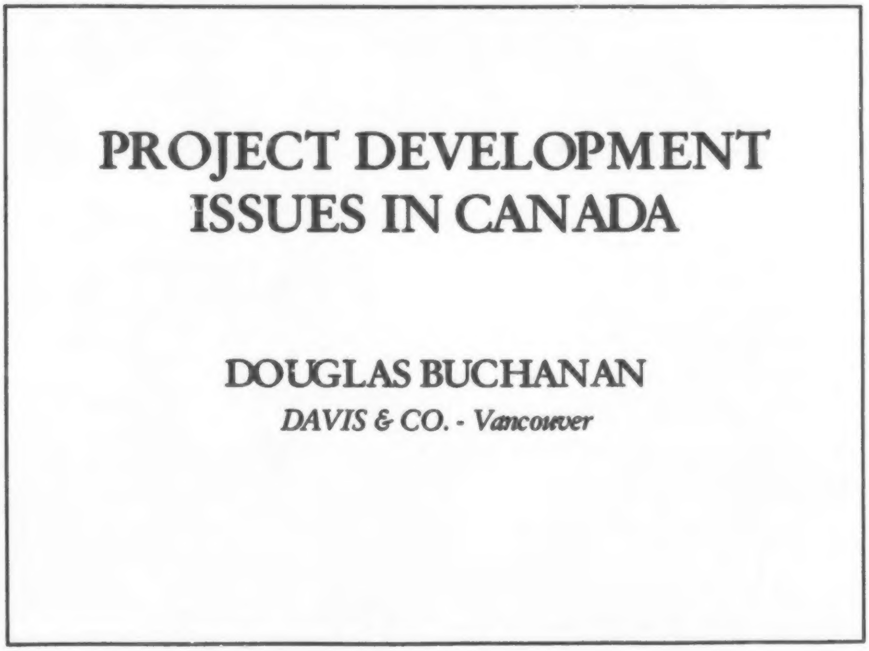
&

JOHN P. STEELE

PDAC & Iriana Resources - Toronto

IRIANA

PDAC



PROJECT DEVELOPMENT ISSUES IN CANADA

DOUGLAS BUCHANAN

DAVIS & CO. - Vancouver

FINDING A PROJECT

JOHN P. STEELE
PDAC & Iriana Resources
Toronto

IRIANA

PDAC

AS A JAPANESE TRADING HOUSE OR MINING COMPANY

HOW DO YOU FIND MINING PROJECTS?

- Work with Previous Partners
- Consult with Major Mining Companies
- Support Active Junior Exploration Companies
  - Suggest you should examine this alternative

IRIANA

PDAC

APPROACH TO SEEKING A PROJECT
A Risk vs Reward Decision

WITH MAJOR MINING COMPANY

Lowest Risk - Lowest Reward

- Finance development of large projects in "safe countries"
- Return is based on Interest and Off-Take

WITH JUNIOR EXPLORATION COMPANY

Highest Risk - Highest Probable Reward

- Finance Junior to discover deposits and to look where little exploration has been done though with higher political risk

---

PROJECT CRITERIA

MAJORS	**JUNIORS**
Large Scale - gold over 2 million ounces	**Scale - can economically mine smaller deposits**
Advanced - at feasibility study or further	**Early Stage - targeting or exploration drilling**
Low Risk - stable political regimes with defined rules	**Higher Risk - succeed in developing countries and move quickly**
Return for Investor - interest & off-take	**Return for Investor - ownership in deposit**

HOW DO YOU FIND THE "RIGHT" JUNIOR

- LOOK AT MANAGEMENT
  - Look at the individual backgrounds and successes
  - Look for efficient, low overhead, operation
  - Examine ability to function in complex environments
  - Very serious, dedicated & knowledgeable
  - Well respected & know in mining community
- TRACK RECORD OF COMPANY
  - Swift and Adept
  - Strong support from the financial community

IRIANA

PORC

WHAT DOES "SUPPORT" YOUR JUNIOR EXPLORER MEAN?

SEVERAL POSSIBLE MECHANISMS

- **Take a Minority Equity Interest (10 to 20%)** *Highest Risk*
  - Junior explores for commodities with most market appeal reflecting current supply and demand
  - Association gives credibility to Junior's financiers
  - Can give Investor "first right to production"
- **Create & Finance Junior Explorer** *Medium Risk*
  - Operate as Junior to give dynamic exploration approach
  - Exploration priorities are those of Investor
- **Provide Project Financing at Construction Stage** *Lowest Risk*
  - Gives the Project Off-Take

IRIANA

PORC

AN INVITATION FROM THE PDAC

Deborah McCombe of Watts Griffis & McQuat &
John Steele of Iriana Resources Corporation
As Co-Chairmen

Invite Participants in
CANADA - A WINDOW ON GLOBAL MINING

to join us in Toronto at our 1999 Convention

THIS IS WHERE TO FIND THE JUNIORS WITH THE PROJECTS

IRIANA

PDAC

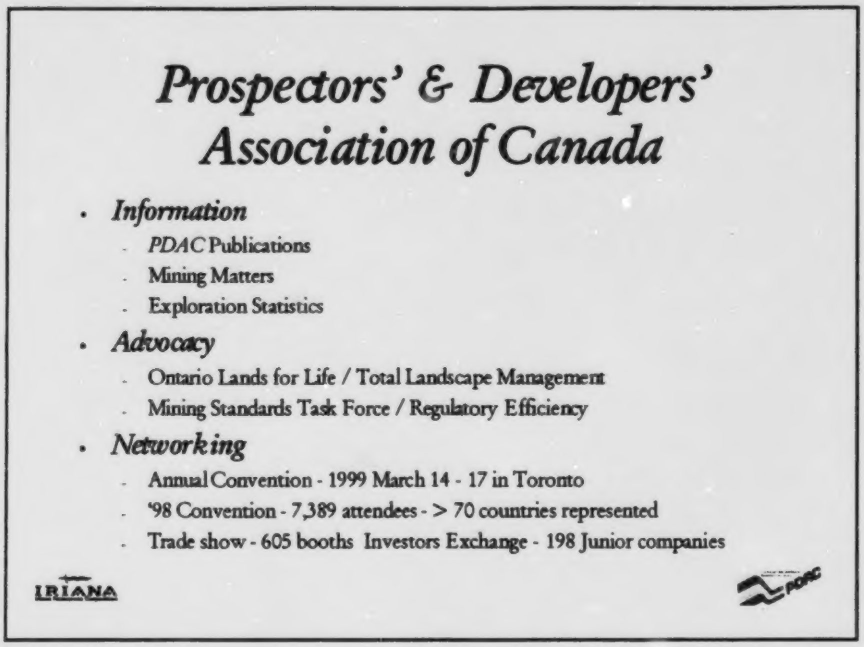
Prospectors' & Developers' Association of Canada

Canada's National Organization
representing the interests of the
Canadian Mineral Exploration Industry

Established in 1932
5,500 Individual
90 Corporate Members

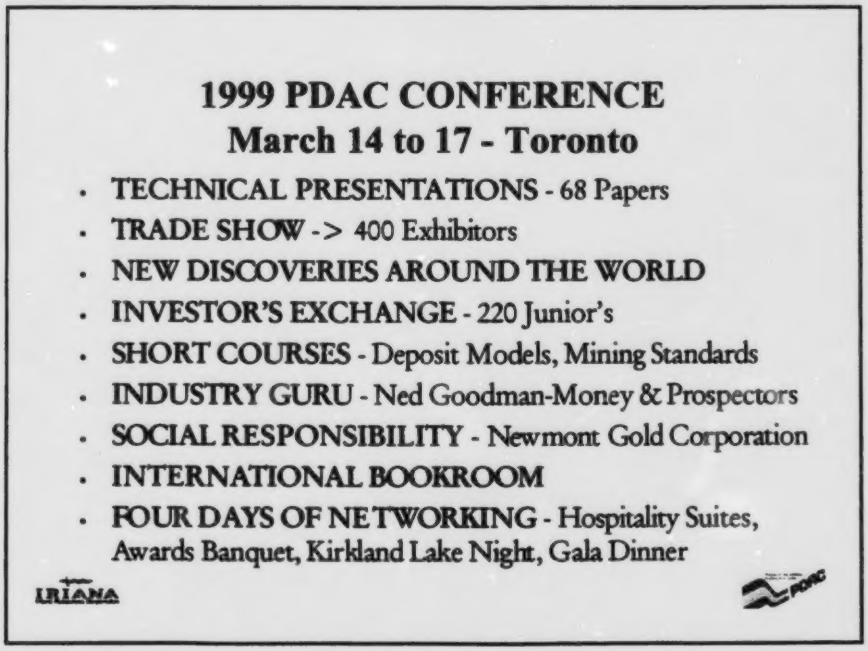
IRIANA

PDAC



Prospectors' & Developers' Association of Canada

- *Information*
  - *PDAC* Publications
  - Mining Matters
  - Exploration Statistics
- *Advocacy*
  - Ontario Lands for Life / Total Landscape Management
  - Mining Standards Task Force / Regulatory Efficiency
- *Networking*
  - Annual Convention - 1999 March 14 - 17 in Toronto
  - '98 Convention - 7,389 attendees - > 70 countries represented
  - Trade show - 605 booths Investors Exchange - 198 Junior companies



1999 PDAC CONFERENCE
March 14 to 17 - Toronto

- TECHNICAL PRESENTATIONS - 68 Papers
- TRADE SHOW -> 400 Exhibitors
- NEW DISCOVERIES AROUND THE WORLD
- INVESTOR'S EXCHANGE - 220 Junior's
- SHORT COURSES - Deposit Models, Mining Standards
- INDUSTRY GURU - Ned Goodman-Money & Prospectors
- SOCIAL RESPONSIBILITY - Newmont Gold Corporation
- INTERNATIONAL BOOKROOM
- FOUR DAYS OF NETWORKING - Hospitality Suites, Awards Banquet, Kirkland Lake Night, Gala Dinner

1999 PDAC CONFERENCE
March 14 to 17 - Toronto

- **TECHNICAL PROGRAMME** - including Feature Sessions
  - An Overview of World Exploration
  - Low Commodity Prices - the Storm before the Calm
  - Alaska & Far East Russia - Operating in Challenging Environments
  - The ABC's (Angola, Botswana & Canada) of Diamond Activity
  - Gold Development in East Africa
  - Australia: Validating the Valuation

1999 PDAC CONFERENCE
March 14 to 17 - Toronto

- NEW DISCOVERIES & DEVELOPMENTS WORLDWIDE
  - **CANADA (Alberta) - Buffalo Head Hills - diamonds**
  - **CANADA (Quebec) - LaRonde - gold**
  - **ALASKA - Pogo - gold**
  - **MEXICO - Escondida - gold**
  - **BOLIVIA - San Cristobal - silver, lead, zinc**
  - **PERU - Mineria Yanacocha - gold**
  - **BRAZIL - Alemao - copper, gold**
  - **SPAIN - El Valle - gold**
  - **AUSTRALIA - Century - zinc**
  - **TANZANIA - Bulyanhulu - gold**
  - **PHILIPPINES - Tampakan - copper, gold**

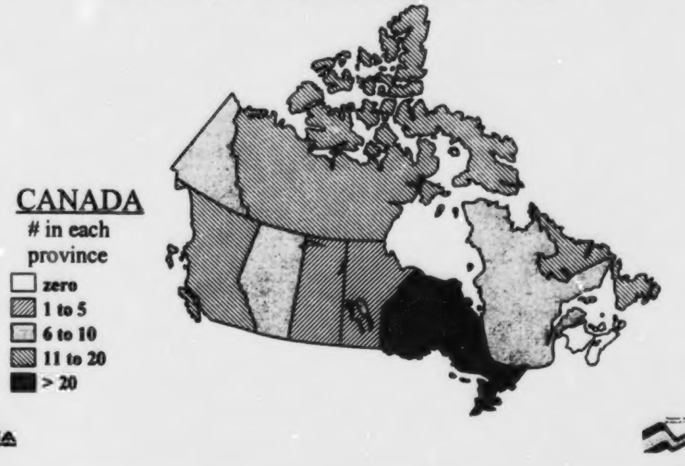
1999 PDAC CONFERENCE
March 14 to 17 - Toronto

- INVESTORS' EXCHANGE & FORUM
  - 220 Junior Exploration Companies presenting their projects both in Canada and Worldwide
  - 8 Major Mining Companies supporting the Juniors
  - Foremost Investment Letter Writers
  - Major Stockbrokers with their mining analysts
  - Canada's Stock Exchanges
- HERE, UNDER ONE ROOF, ARE THE JUNIOR CANADIAN EXPLORATION COMPANIES FROM WHICH TO CHOOSE

IRIANA

PDAC

JUNIOR EXPLORERS IN 1998 INVESTORS EXCHANGE

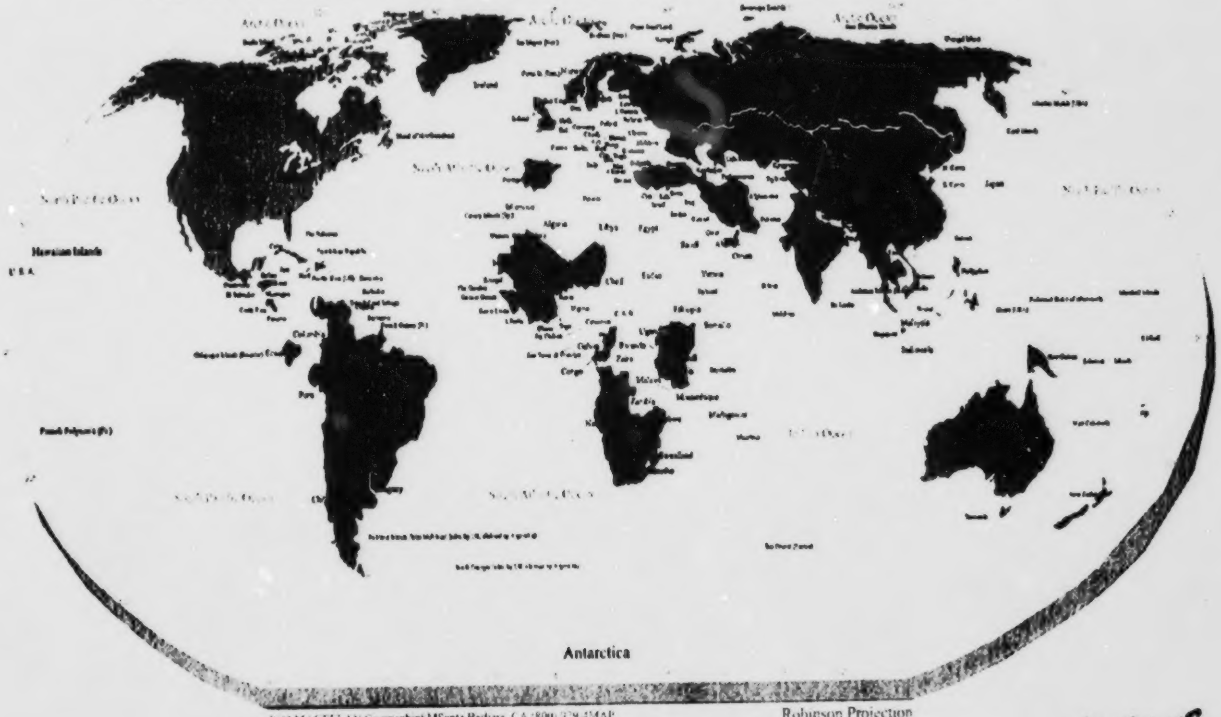


IRIANA

PDAC

JUNIOR EXPLORERS IN THE 1998 INVESTORS EXCHANGE

ACTIVITIES OF INVESTOR'S EXCHANGE "JUNIORS" 1998


Hawaiian Islands
U.S.A.
Algeria
Libya
Egypt
Japan
Antarctica

©93 MAGELLAN GeographixSMSanta Barbara, CA (800) 929-4MAP

Robinson Projection

WORLD

# in each country

- ☐ **zero**
- ■ **1 to 2**
- ■ **3 to 5**
- ■ **6 to 10**
- ☐ **11 to 15**
- ■ **> 15**

IRIANA
Iriana Resources Corporation

PDAC

Setting New Standards for Canadian Mining Companies on the Toronto Stock Exchange

■ ■ ■ ■ ■ ■ ■ ■ ■ ■ ■ ■ ■ ■

Notes for Remarks

Michael J. Bourassa
Partner
Aird & Berlis

CANADA: A Window on Global Mining
World-Class Technology and Investment Prospects

Canadian Embassy
Tokyo, Japan
February 16, 1999

Michael J. Bourassa

Partner
Aird & Berlis

Michael is a partner and member of the Natural Resource and Environmental Practice Groups at the law firm of Aird & Berlis, Toronto, Ontario. Mr. Bourassa was legal counsel to the Ontario Ministry of Northern Development and Mines from 1986 to 1990 and participated in the drafting of the 1990 Amendments to the Ontario *Mining Act*. He has extensive experience on mining due diligence issues concerning title, technical matters and environmental risks and has travelled to Africa, Central Asia and South America on behalf of clients. Mr. Bourassa has been a guest speaker on the topic of mine closure and environmental remediation at several conferences over the past few years. In September 1997 he was a guest speaker at the 10th Annual Gold Symposium in Rio de Janeiro, Brazil on the topic of the legal framework necessary to secure foreign mineral investment in emerging economies. He has been an active member of the Land Access Committee of the Prospectors and Developers Association of Canada as well as serving on the Canada-wide Whitehorse Mining Initiative, a multi-faceted group which recommended policy initiatives to the federal and provincial governments in order to stimulate the Canadian mining industry.

Aird & Berlis is a full service, international mining law firm based in Toronto, Canada, providing advice on: international due diligence; securities regulations on accessing North American markets; mineral policy and strategy; and mineral exploration/mining agreements of all types.

Setting New Standards for Canadian Mining Companies on The Toronto Stock Exchange

Good morning, Ladies and Gentlemen. My name is Michael Bourassa and I am a partner and member of the Natural Resource Practice Group at the law firm of Aird & Berlis in Toronto.

First I would like to outline what I am going to cover today:

- The importance of mining to the Canadian Capital Markets
- The importance of mining to the Toronto Stock Exchange (the "TSE")
- The Mining Standards Task Force ("MSTF") -- Background
- The MSTF Final Report & Recommendations
- Conclusions
- What Happens Next

Slide 1

For mining companies looking to establish a strong North American presence, raise profile, finance and position themselves for future growth, there is no other destination in the world that can offer a mining company – whether an established blue chip or promising junior – the same opportunities as Canada.

Despite the historically poor world commodity markets and shaky investor sentiment towards junior explorers that we see today, caused in part by fallout from the high profile Bre-X fraud, Canada continues to shine as the undisputed mining finance capital of the world.

Canada has actively created and maintained one of the most integrated national frameworks to support mining ventures of all kinds, from one-person grass-roots explorers to mining industry giants, who are Canada-focused or internationally active. The mining industry continues to be a vital contributor to the Canadian economy, contributing $26.2 billion in 1997 or 3.8% of national GDP and is the second largest earner of foreign exchange.

Slide 2

The system of Canadian capital markets can accommodate almost any level of mining enterprise.

Exploration companies tend first to list on one of the venture capital exchanges, such as the Vancouver Stock Exchange or The Alberta Stock Exchange.

From there as they grow they graduate to the TSE. They can do this once they meet the TSE's more rigorous listing requirements. Senior mining companies are traded primarily on the TSE and the Montreal Exchange, with the highest proportion being listed on the TSE.

Slide 3

Canada is a world leader in both the mining industry and mining finance. The number of head offices based in Canada, as well as the concentration of industry analysts, engineers, geologists, consultants, lawyers and investment bankers, is testimony to Canada's position. Canadian capital markets have also developed the infrastructure to service mining companies of all sizes, from junior exploration companies to multinational producing companies. The TSE is the leading exchange globally for the mining sector, as illustrated by the number of resource stocks it trades and the amount of mining finance raised through it.

The TSE accounted for more than one-third of global mining financings in 1997. Of the seven major mining exchanges in the world about 43% of new equity finance was raised by TSE-listed companies in 1997. In 1998, TSE companies raised almost $2.5 billion up to September 30, out of about $6.2 billion in world-wide planned mining financing.

Of the over 1,450 TSE listings at the end of June 1998, 301 were mining-related.

The TSE continues to dominate mining finance for many reasons. With a critical mass of $1.3 trillion in market capitalization and accounting for 85% of the total value of trading on all Canadian exchanges in 1997, the TSE provides liquidity and sustains new flows of market capital. A total of 193 new companies ($30 billion market capitalization) listed in 1997, of which 29 were mining companies.

Mining continues to be extremely important to the TSE, evidenced by the fact that more than 20% of the Exchange's prestigious TSE 35 Index is made up of mining companies. About 25% of the trading on the TSE is from mining sector and of the 300 companies about 35 are industrial mineral companies.

The TSE recently formed a mining team to service its listed companies needs. The mining team pools expertise and experience in international mining, geology, economics, financing and investor relation's disciplines so as to provide a full spectrum of guidance and support to mining companies considering listing on the TSE.

The TSE is committed to being involved in significant issues for the mining industry. This is a role to which the TSE and other Canadian regulators are deeply committed.

The TSE is leading the way in mining finance regulation, disclosure standards and investor protection.

Slide 4

WHY WAS THE MINING STANDARDS TASK FORCE ESTABLISHED?

A number of incidents relating to the securities of mineral exploration and mining companies served as an impetus to the formation of a joint task force by the Ontario Securities Commission and the TSE. Public confidence in the securities of such companies was shaken, and the industry as a whole suffered a major setback. The most talked about incident was, of course, the failure of Bre-X.

As I stated earlier, mining is important to the TSE and Canadian capital markets. The TSE formed the Task Force in 1997 to establish higher standards as a means to reinforce Canada's leadership role and expertise in the mining industry, and to increase investor confidence.

Slide 5

WHAT APPROACH WAS TAKEN BY THE MSTF?

The Task Force consulted widely during its initial series of meetings. Representatives from the mining, assaying and securities industries, consultants, professional associations, internationally recognized authorities, government departments and foreign and domestic regulators were invited to provide written submissions and presentations. A total of 46 written submissions and 15 presentations were received by the Task Force. The Task Force also commissioned a report from Micon International Limited on scientific and technical issues to support its analysis.

Slide 6

In April 1997 the TSE and the Ontario Securities Commission announced their intention to establish a joint task force to examine the need to set standards for mineral exploration and mining companies on how efficient exploration programs should be carried out and on how the results should be disclosed.

The Interim Report was released in June 1998 and presented 55 recommendations in order to encourage investor confidence back into the mining sector.

The recommendations were hotly debated and started an industry-wide discussion on the definition of professional standards for the Canadian mining industry.

Slides 7 and 8

The Interim Report was released for public comment to ensure that the Task Force would have the benefit of feedback from affected parties, before releasing its Final Report.

A total of 102 submissions were received from junior exploration companies, senior mining companies, industry associations, mining professionals, laboratories, law firms, accounting firms, government departments, securities firms and analysts.

Some of the international companies and associations which submitted written responses are shown on the next 2 slides.

Slide 9

The Final Report was released exactly 2 weeks ago, on February 2, 1999. The Final Report contains 66 recommendations and endeavours to clarify and explain recommendations made in the Interim Report. The slides which follow are a summary of the Final Report's recommendations.

Slide 10, 11 and 12

The "Qualified Person" Concept

The Task Force recommends the formalization and enhancement of the Qualified Person ("QP") concept in the Canadian mining industry.

- The integrity of the system, both in the field and in the public disclosure of exploration and mining results, relies on professional engineers and geoscientists who are regulated by self-regulating professional bodies with disciplinary powers.
- The proposed QP concept is broader than the "Competent Person" concept used in other major mining jurisdictions. The Task Force has significantly broadened the QP concept in its recommendations by: i) making the QP responsible for ensuring that industry standards and best practice guidelines are followed; ii) requiring the company to ensure that all scientific and technical disclosure is based on the work of a QP; and iii) requiring, in a number of special circumstances, that reports be prepared by independent Qps.
- QP's will be required to oversee exploration and field programs ensuring that the best practice guidelines are effectively applied.
- QP's preparing a technical report must take reasonable steps to verify the integrity of the data or information being relied on; provide an opinion as to the quality of the data or information and the basis for this opinion; and disclose the source of the data or information, including whether independent samples have been taken.

- Canadian securities regulatory authorities and stock exchanges will identify which Canadian and foreign professional associations will be recognized for the purposes of defining who may qualify as a Qualified Person.

Slides 13 and 14

Higher Disclosure Standards

The Task Force proposes to set higher disclosure standards, which will improve the quality of disclosure by exploration and mining companies. These higher disclosure standards address:

- disclosure of exploration results;
- the establishment of clear national standards for the reporting of resource and reserve estimates;
- the establishment of detailed guidelines for the content of news releases;
- the disclosure of certain legal, social, environmental and political issues that might affect land tenure; and
- the establishment of international standards for the reporting of production costs.

Slides 15, 16 and 17

Production Costs

A standard format for reporting production costs would allow investors to better compare results of operations. Comparability of production costs is key to investors' understanding and their ability to compare mineral properties.

"Cost per Ounce Reporting" forms the basis upon which most gold producers are compared to one another.

Listed mineral exploration and mining companies should use, when they report gold production costs, the Gold Institute's method of calculating and reporting actual or projected production costs.

It is time to reinforce and expand this standard for gold reporting, to enable investors to better understand and compare the results of different companies.

The Canadian Institute of Chartered Accountants or the Society of Management Accountants of Canada, in conjunction with the Canadian Institute of Mining, Metallurgy and Petroleum are encouraged to undertake a research study with a view to standardizing the terminology, the calculation methods used for determining the cost estimates, and the reporting of production costs for a variety of commodities, which would give investors more information.

Slide 18

Uniform Rules Across Canada

The Report advocates national uniformity in regulation and improved regulatory oversight.

- Securities commission and stock exchange rules should be uniform across Canada (except in the area of listing standards) in order to clarify Canadian rules for both domestic and international companies and investors.
- This objective should be reinforced through mechanisms such as the establishment of a national technical advisory committee.
- Compliance with existing and proposed rules requires an effective deterrence mechanism. Police agencies, securities regulatory authorities and criminal justice officials require additional resources for their enforcement functions in order to ensure that adequate deterrence is in place.

Slides 19, 20 and 21

Establish Industry Standards

There is a need to establish a number of mining and related industry standards, namely

- "best practice" guidelines for the conduct of mineral exploration programs, development programs and mining operations;
- standards for reporting resource and reserve estimates and exploration and mining activities;
- accreditation and quality control standards for analytical laboratories;
- the establishment of required standards for technical reports that disclose exploration information;
- increased attention by Canadian mining companies to sound corporate governance practices; and
- standards of professionalism and supervision for mining analysts.

Slide 22 and 23

Role of Mining Research Analysts

One of the major features of the Final Report are the recommendations dealing with the role of securities firms and mining research analysts.

- TSE member firms, through their compliance functions, must ensure that their analysts comply with the "Code of Ethics" and the "Standards of Professional Conduct" established by the Association for Investment Management and Research, whether or not they are members of that organization.

- The TSE, as part of its oversight of members' activities, is recommended to selectively monitor analysts' reports to ensure that the terminology and standards of disclosure required by Canadian securities regulatory authorities and stock exchanges are employed in the analysts' reports.
- Canadian self-regulatory organizations are recommended to establish minimum industry standards governing the supervision and conduct of all research analysts.

Analysts Reports

- Analysts must distinguish clearly in their reports and recommendations between information disclosed by a mining company and the analysts' own opinions and projections.
- Analysts will have to disclose their qualifications and experience, and state the basis of their calculations and projections, in all research reports that include comment on the merits of a mineral property.
- TSE member firms must ensure that their analysts disclose any conflicts of interest in their research reports. Research reports should disclose whether the analyst, or anyone in the research group, holds securities in the company being reviewed, including the amount of securities held. The research report should also disclose whether anyone in the member firm is an insider of the company being reviewed.
- Analysts must employ in their research reports and presentations, the terminology and standards of disclosure that mineral exploration and mining companies are required to use in disclosing the results of exploration and development programs, mining operations and the reporting of resources and reserves, as required by Canadian securities regulatory authorities and stock exchanges.

Slide 24

SO WHO ARE THE TASK FORCE RECOMMENDATIONS AIMED AT?

- Listed mining companies
- Stock exchanges
- Securities regulators
- Brokerage firms
- Royal Canadian Mounted Police
- Professional association; and
- Mining Industry associations

Slides 25, 26 and 27

CONCLUSIONS

The recommendations in the Final Report are designed to assist in reducing fraud and misleading disclosure, but cannot prevent them. As has been stated frequently by numerous sources, it is impossible to eliminate fraud through regulation alone. However, by raising standards it is anticipated that any fraud can be exposed at an earlier stage.

The Task Force has attempted to identify and address areas where improved regulatory requirements and industry practices can be expected to instill greater investor confidence and support Canada's leadership role in mining finance.

The MSTF Final Report raises the standards bar to the highest possible level and maintains Canada's leadership role in the mineral industry.

The recommendations are a return to basics, by stressing the importance of:
- Quality People - -Management and Consultants
- Quality Work - - Exploration and Mining Programs
- Quality Information - -Disclosure of Results

Slides 28 and 29

SO . . . WHAT HAPPENS NEXT?

Already, proposed Guidelines have been prepared as a result of the Task Force's work.

Work has been done to update and consolidate reporting requirements for publicly traded Canadian mineral exploration and mining companies. National Instrument 43-101, was released for public comment in draft form by the Canadian Securities Administrators in July 1998. This National Instrument will establish the terms and references for technical reports on mineral properties and set out new requirements for the disclosure of results. Many of the Task Force's recommendations are paralleled in the requirements of NI 43-101, and the two documents can usefully be read together.

Reforms based on the MSTF Final Report will be implemented by the TSE and the provincial Securities Commissions. New legislation will be promulgated in Ontario to provide self-regulating professional status for the Association of Geoscientists of Ontario. Minimum industry standards for mining research analysts are expected to be established imminently.

The Task Force views the Final Report as an action plan rather than a policy statement. It urges the regulators, exchanges, industry participants and others cited in its recommendations to act expeditiously.

Closing Remarks

That concludes my presentation for today. Thank you very much for your attention. I will be available for questions at one of the display tables in the exhibition area near the auditorium. Copies of my speaking notes and slides will also be available. Several copies of the full MSTF Final Report are being provided to the Embassy library and will be available for any of you to review in greater detail.

Mining Standards Task Force

Setting New Standards for the Canadian Mining Industry

CANADA: A Window on Global Mining World-Class Technology and Investment Prospects

Canadian Embassy
Tokyo, Japan
February 16-17, 1999

Michael J. Bourassa
Partner
Aird & Berlis

TSE
Toronto Stock Exchange

AIRD & BERLIS
BARRISTERS & SOLICITORS

SLIDE 1

Canada and Mining

- Vibrant industry with a solid history
- Global Leader in Mining Finance
- Access to capital is vital to its success
- Investor confidence is critical to capital market access
- Global focus has had a strong impact on the speed of change and investors' understanding

TSE
Stock Exchange

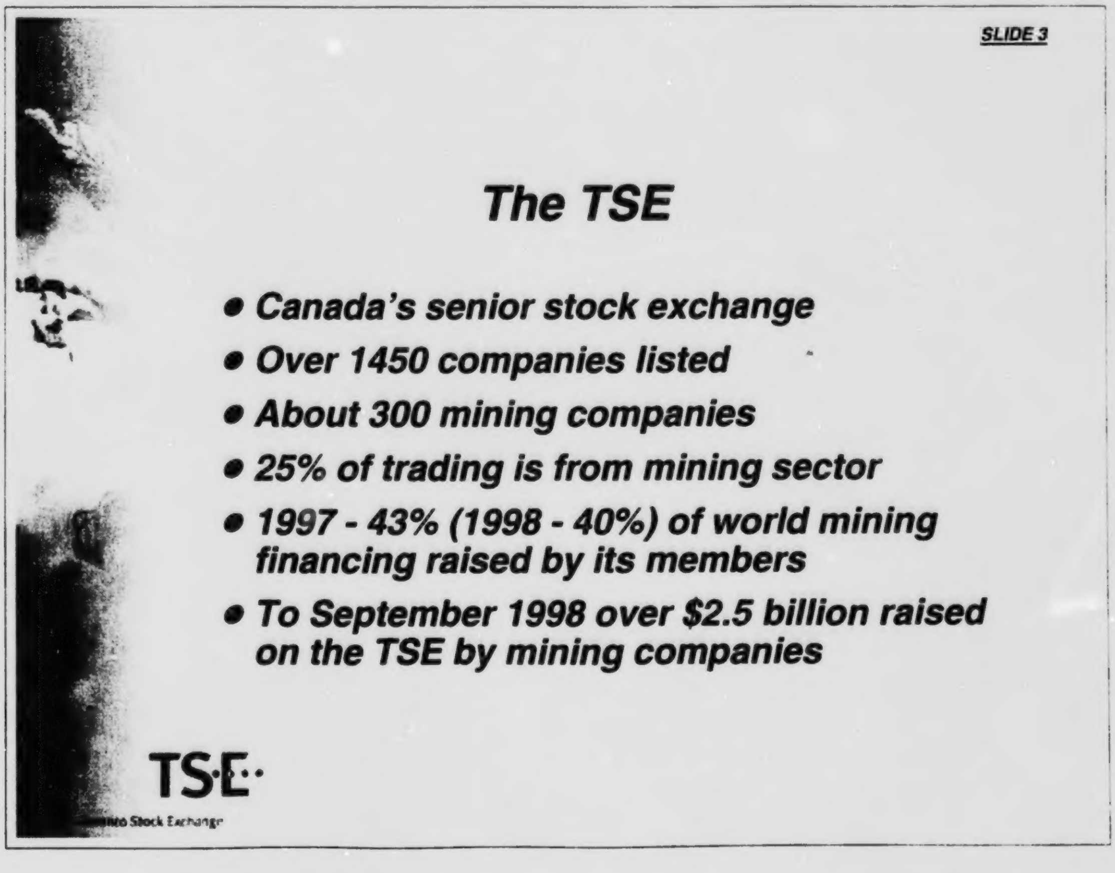
Mining Standards Task Force

Canadian Capital Markets

- The capital markets system in Canada is its strength
- Junior markets --- Vancouver Stock Exchange, Alberta Stock Exchange, Canadian Dealing Network
- Senior markets -- Toronto Stock Exchange, Montreal Exchange

TSE
Toronto Stock Exchange

AIRD & BERLIS
BARRISTERS & SOLICITORS



The TSE

- Canada's senior stock exchange
- Over 1450 companies listed
- About 300 mining companies
- 25% of trading is from mining sector
- 1997 - 43% (1998 - 40%) of world mining financing raised by its members
- To September 1998 over $2.5 billion raised on the TSE by mining companies

TSE
Toronto Stock Exchange

Mining Standards Task Force

Why a Mining Standards Task Force ?

- Public confidence in mining stocks has been shaken
- Need to reinforce Canada's leadership role and expertise in the mining industry
- Mining is important to the TSE and Canadian capital markets
- Higher mining standards required to increase investor confidence

TSE
Toronto Stock Exchange

AIRD & BERLIS
BARRISTERS & SOLICITORS

The Task Force Approach

- Commissioned a survey of mineral exploration and mining companies
- Commissioned a report on technical issues from a technical consulting firm – Micon International
- Invited submissions and presentations from representatives of the mining, assaying and securities industries, consultants, professional associations and internationally recognized authorities

TSE
Stock Exchange

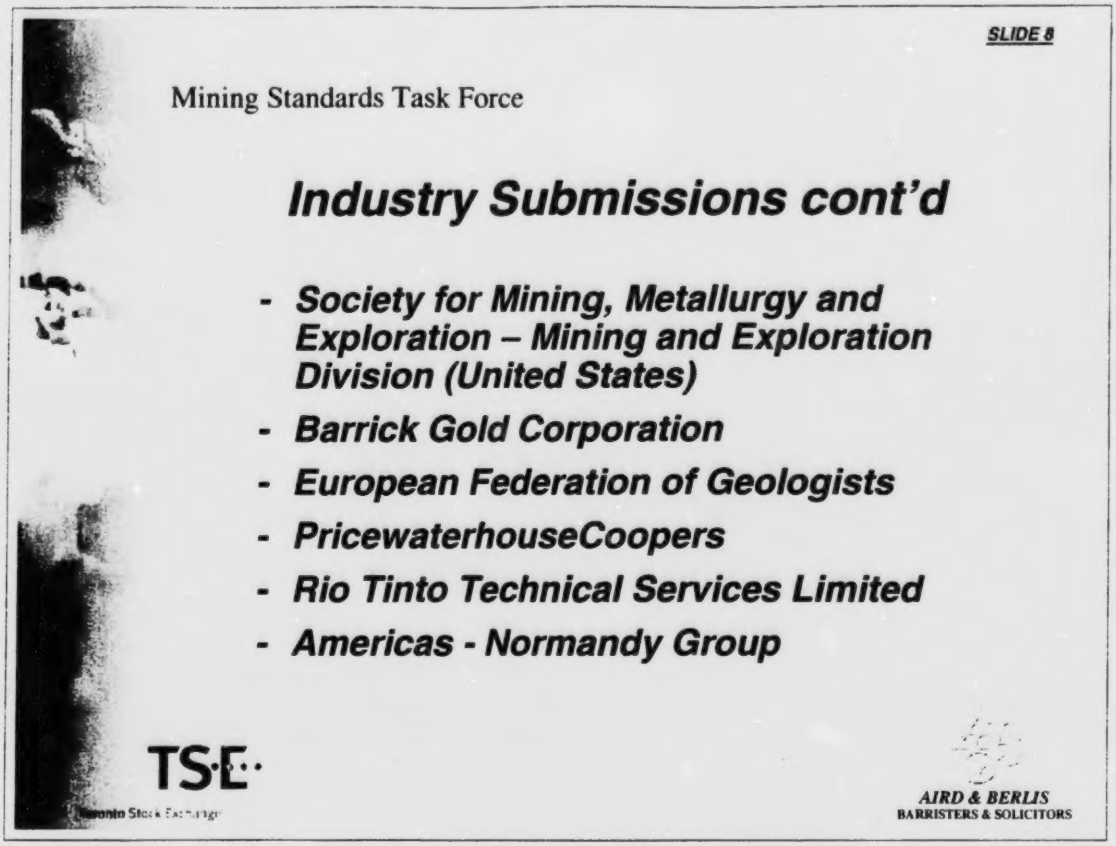
Mining Standards Task Force

TSE and the Mining Standards Task Force

- Formed the MSTF with the Ontario Securities Commission in 1997
- Released interim report in June 1998
- 55 Recommendations were made in Interim Report

Industry Submissions

- Over 100 written responses to Interim Report, from international companies and associations, including:
  - Australasian Institute of Mining & Metallurgy
  - Australasian Joint Ore Reserves Committee
  - Canadian Institute of Mining, Metallurgy and Petroleum
  - Prospectors and Developers Association of Canada



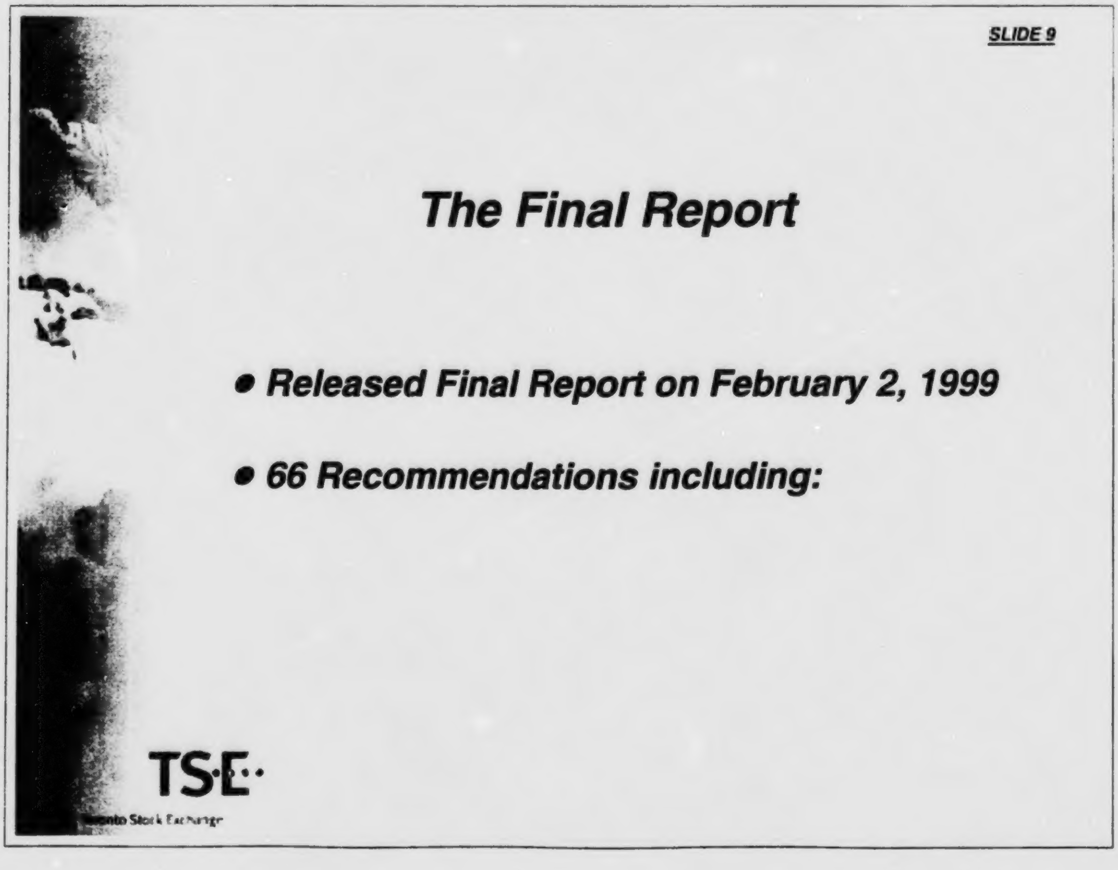
Mining Standards Task Force

Industry Submissions cont'd

- Society for Mining, Metallurgy and Exploration – Mining and Exploration Division (United States)
- Barrick Gold Corporation
- European Federation of Geologists
- PricewaterhouseCoopers
- Rio Tinto Technical Services Limited
- Americas - Normandy Group

TSE
Toronto Stock Exchange

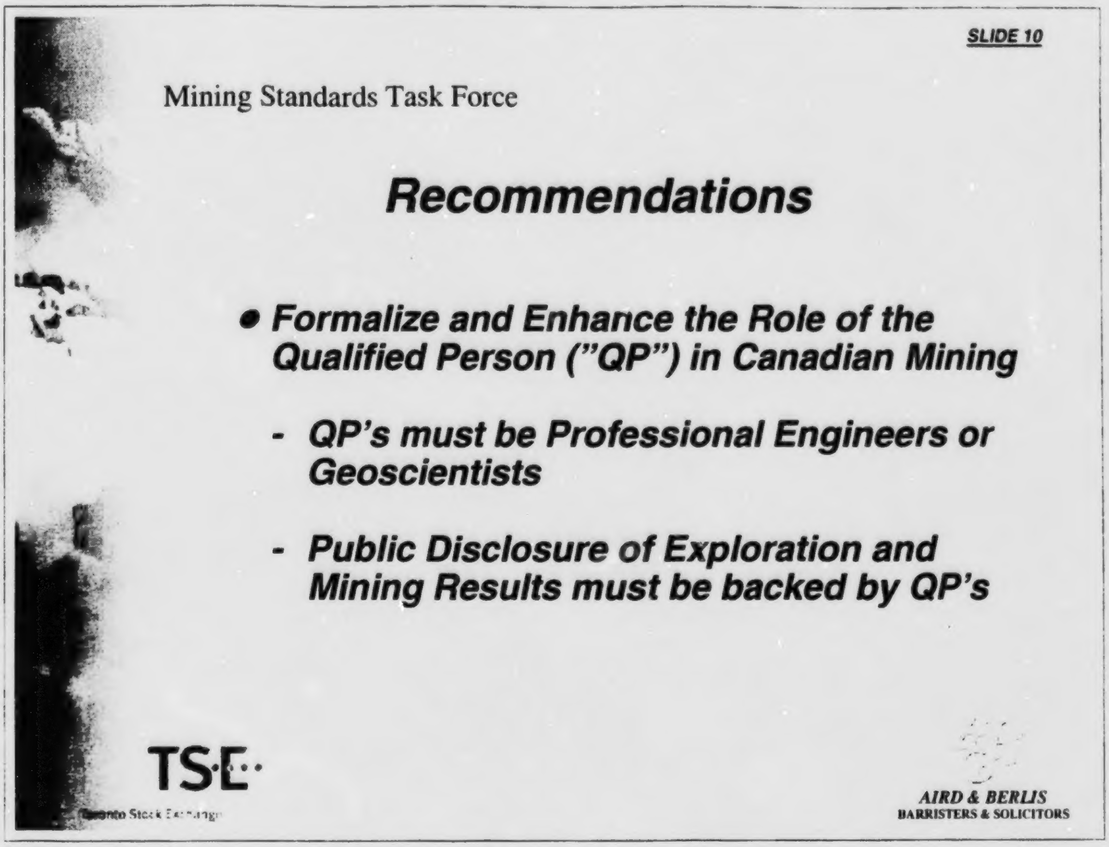
AIRD & BERLIS
BARRISTERS & SOLICITORS



The Final Report

- Released Final Report on February 2, 1999
- 66 Recommendations including:

TSE
Toronto Stock Exchange



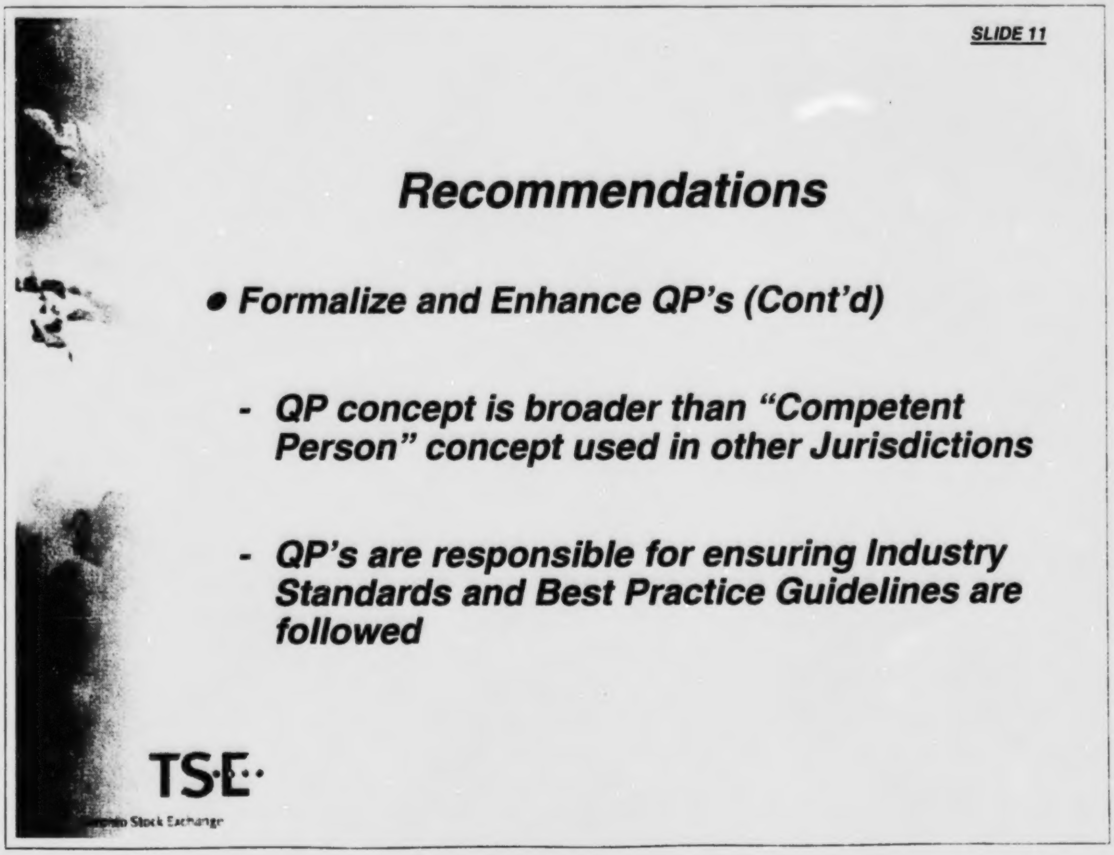
Mining Standards Task Force

Recommendations

- Formalize and Enhance the Role of the Qualified Person ("QP") in Canadian Mining
  - QP's must be Professional Engineers or Geoscientists
  - Public Disclosure of Exploration and Mining Results must be backed by QP's

TSE
Stock Exchange

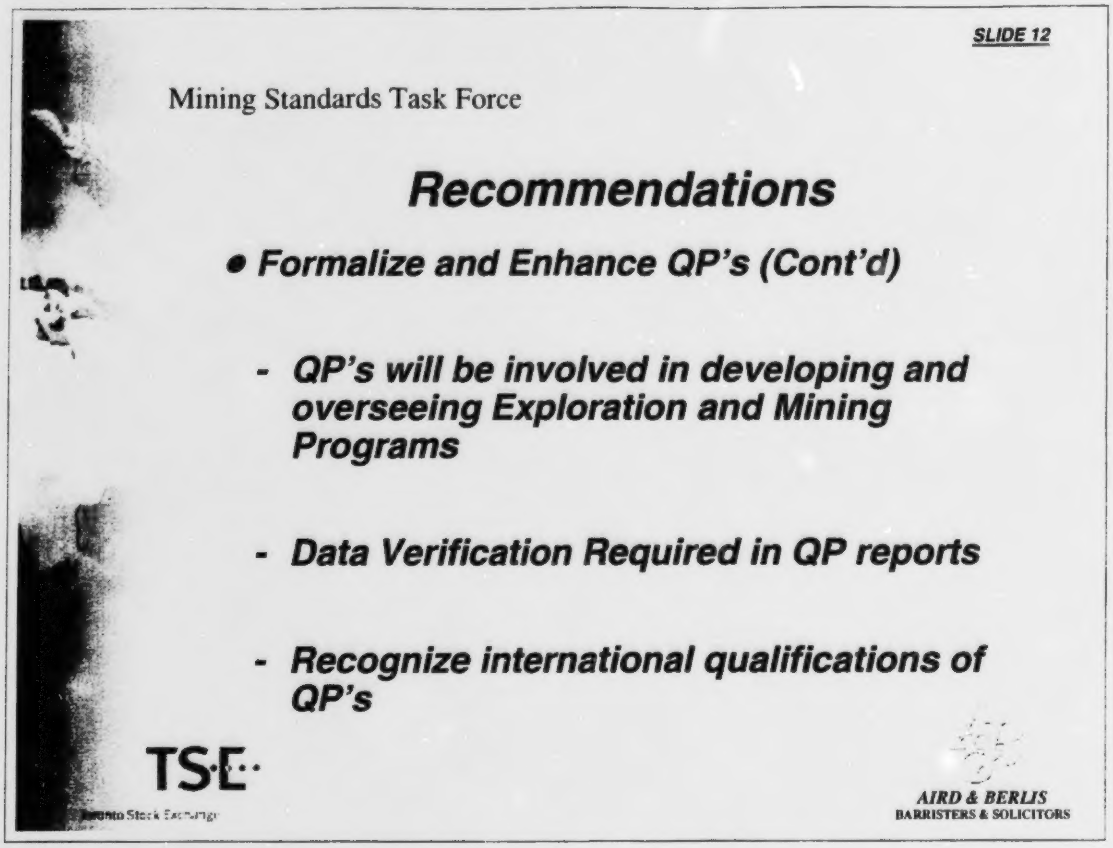
AIRD & BERLIS
BARRISTERS & SOLICITORS



Recommendations

- Formalize and Enhance QP's (Cont'd)
  - QP concept is broader than "Competent Person" concept used in other Jurisdictions
  - QP's are responsible for ensuring Industry Standards and Best Practice Guidelines are followed

TSE
Stock Exchange



Mining Standards Task Force

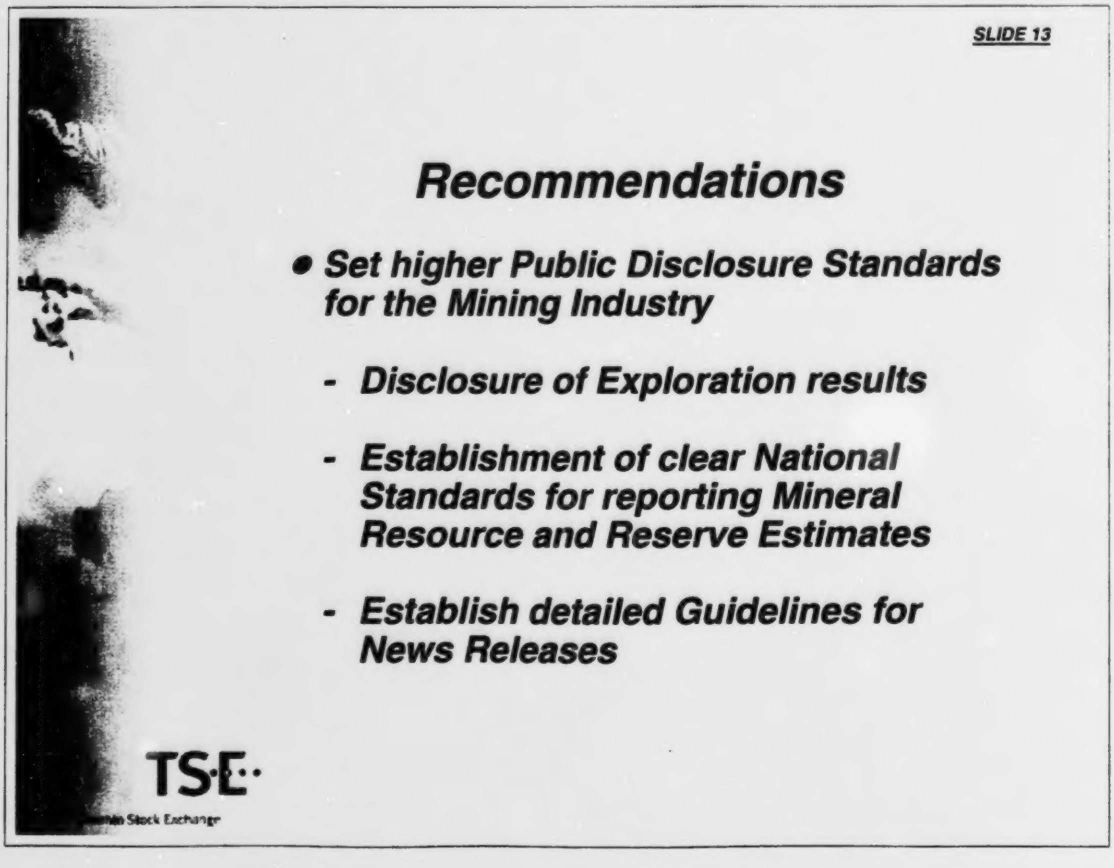
Recommendations

- **Formalize and Enhance QP's (Cont'd)**
  - **QP's will be involved in developing and overseeing Exploration and Mining Programs**
  - **Data Verification Required in QP reports**
  - **Recognize international qualifications of QP's**

TSE

onto Stock Exchange

AIRD & BERLIS
BARRISTERS & SOLICITORS

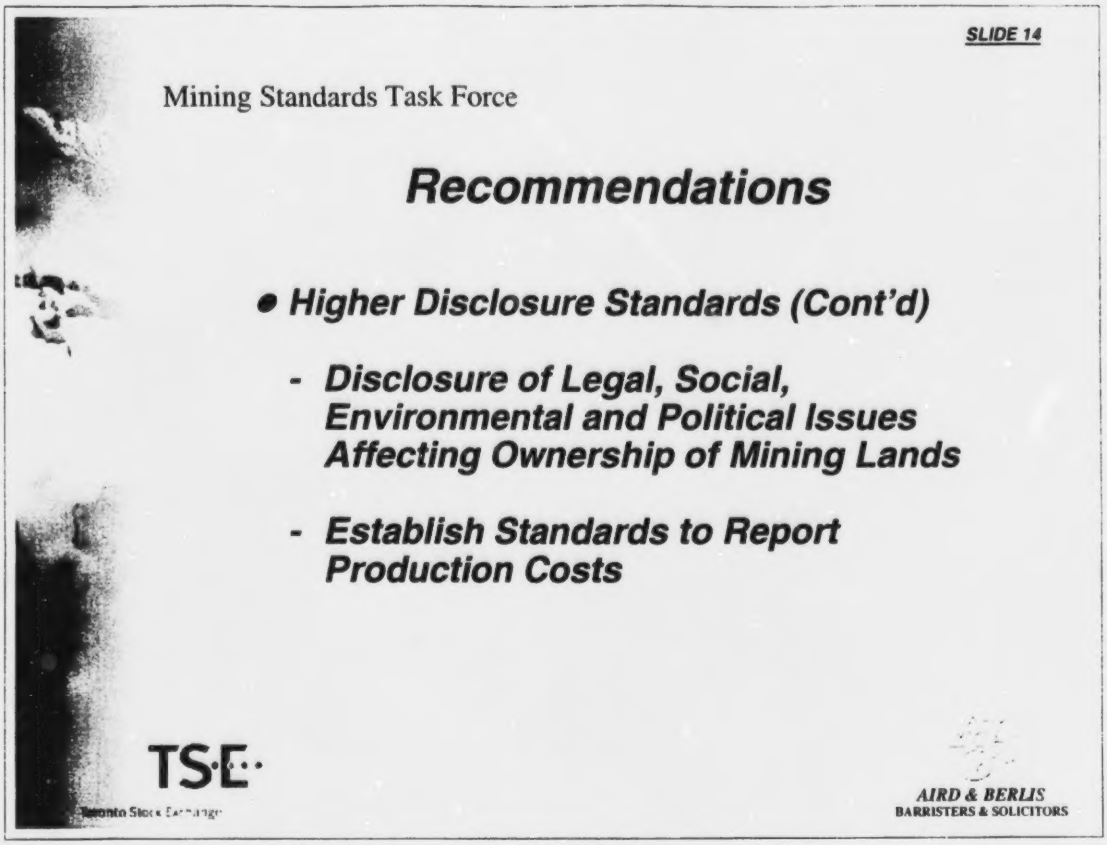


Recommendations

- **Set higher Public Disclosure Standards for the Mining Industry**
  - **Disclosure of Exploration results**
  - **Establishment of clear National Standards for reporting Mineral Resource and Reserve Estimates**
  - **Establish detailed Guidelines for News Releases**

TSE

Stock Exchange



Mining Standards Task Force

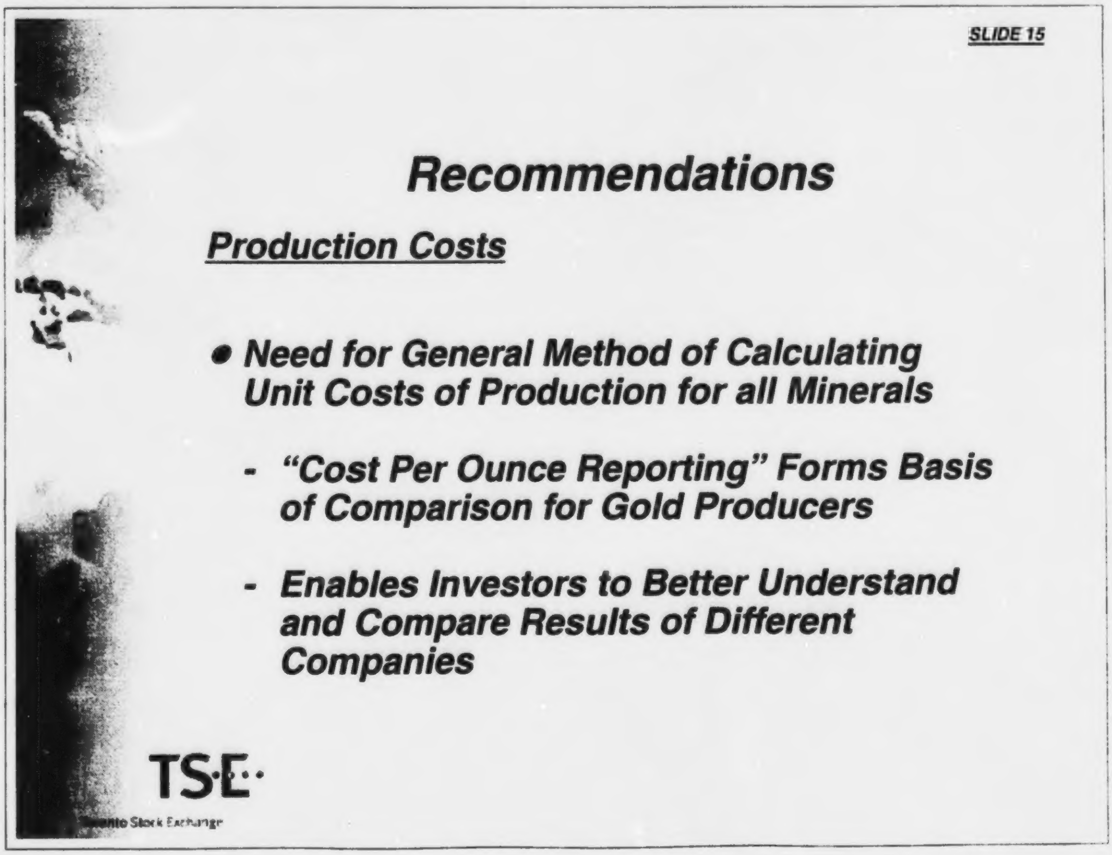
Recommendations

- **Higher Disclosure Standards (Cont'd)**
  - **Disclosure of Legal, Social, Environmental and Political Issues Affecting Ownership of Mining Lands**
  - **Establish Standards to Report Production Costs**

TSE

Toronto Stock Exchange

AIRD & BERLIS
BARRISTERS & SOLICITORS



Recommendations

Production Costs

- **Need for General Method of Calculating Unit Costs of Production for all Minerals**
  - **"Cost Per Ounce Reporting" Forms Basis of Comparison for Gold Producers**
  - **Enables Investors to Better Understand and Compare Results of Different Companies**

TSE

Toronto Stock Exchange

Mining Standards Task Force

Recommendations

Production Costs Cont'd

- Recommendation to use the Gold Institute's "Reporting of Production Costs per Ounce" for Gold

TSE
Toronto Stock Exchange

AIRD & BERLIS
BARRISTERS & SOLICITORS

Recommendations

Production Costs Cont'd

- Recommendation for Industry Associations to Establish Similar System for Base and Other Minerals, by standardizing:
  - Calculation Methods
  - Terminology
  - Reporting Methods

TSE
Toronto Stock Exchange

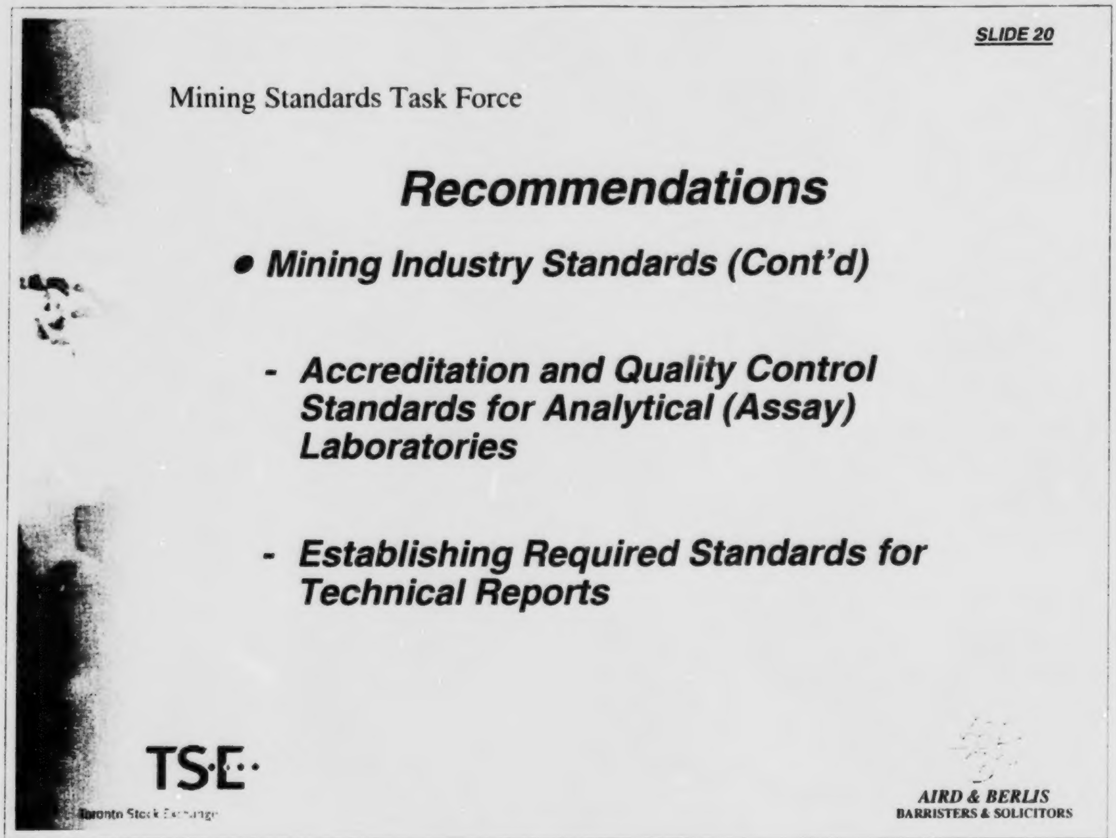
Mining Standards Task Force

Recommendations

- **_Work towards Uniformity of Rules of Securities Commissions and Stock Exchanges across Canada_**
  - **_Clarify Canadian Rules for Domestic and International Companies and Investors_**
  - **_Establish a National Technical Advisory Committee_**
  - **_Provide Additional Resources for Enforcement by Police Agencies and Securities Regulators_**

Recommendations

- **_Establishment of Mining and Related Industry Standards_**
  - **_"Best Practice" Guidelines for Conduct of Mineral Exploration Programs, Development Programs and Mining Operations_**
  - **_Standards for Reporting Resource and Reserve Estimates_**



Mining Standards Task Force

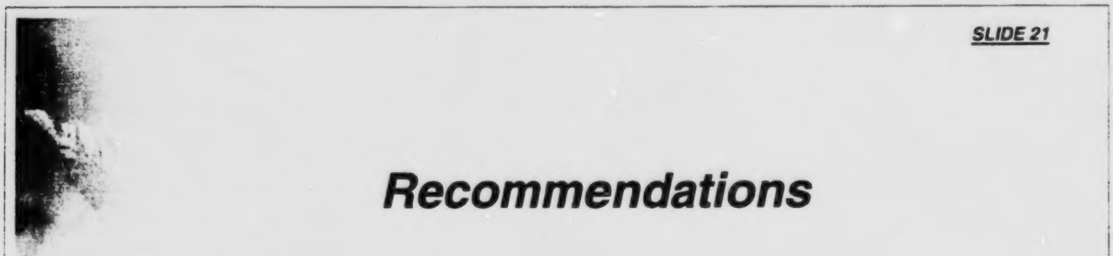
Recommendations

- ***Mining Industry Standards (Cont'd)***
  - ***Accreditation and Quality Control Standards for Analytical (Assay) Laboratories***
  - ***Establishing Required Standards for Technical Reports***

TSE

Toronto Stock Exchange

AIRD & BERLIS
BARRISTERS & SOLICITORS

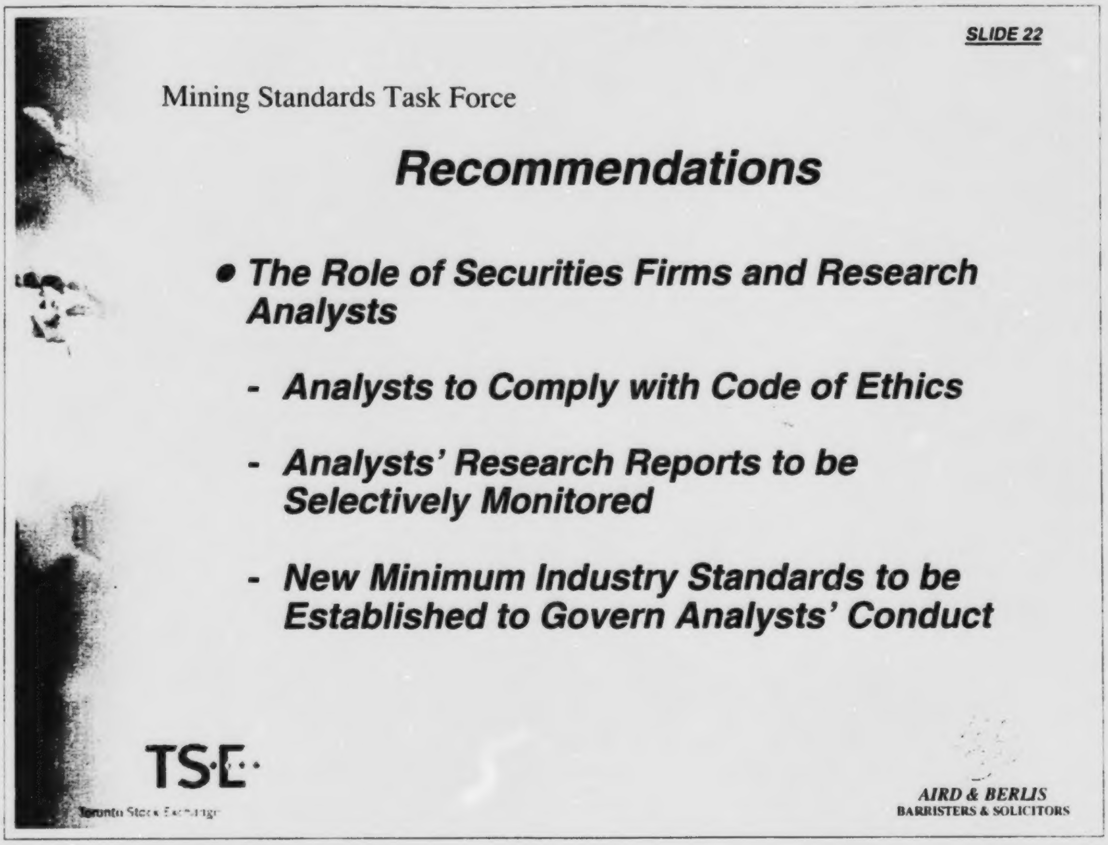


Recommendations

- ***Mining Industry Standards (Cont'd)***
  - ***Establishing Sound Corporate Governance Practices for Mining Companies***
  - ***Establishing Professional Standards and Supervision for Securities Mining Analysts***

TSE

Toronto Stock Exchange



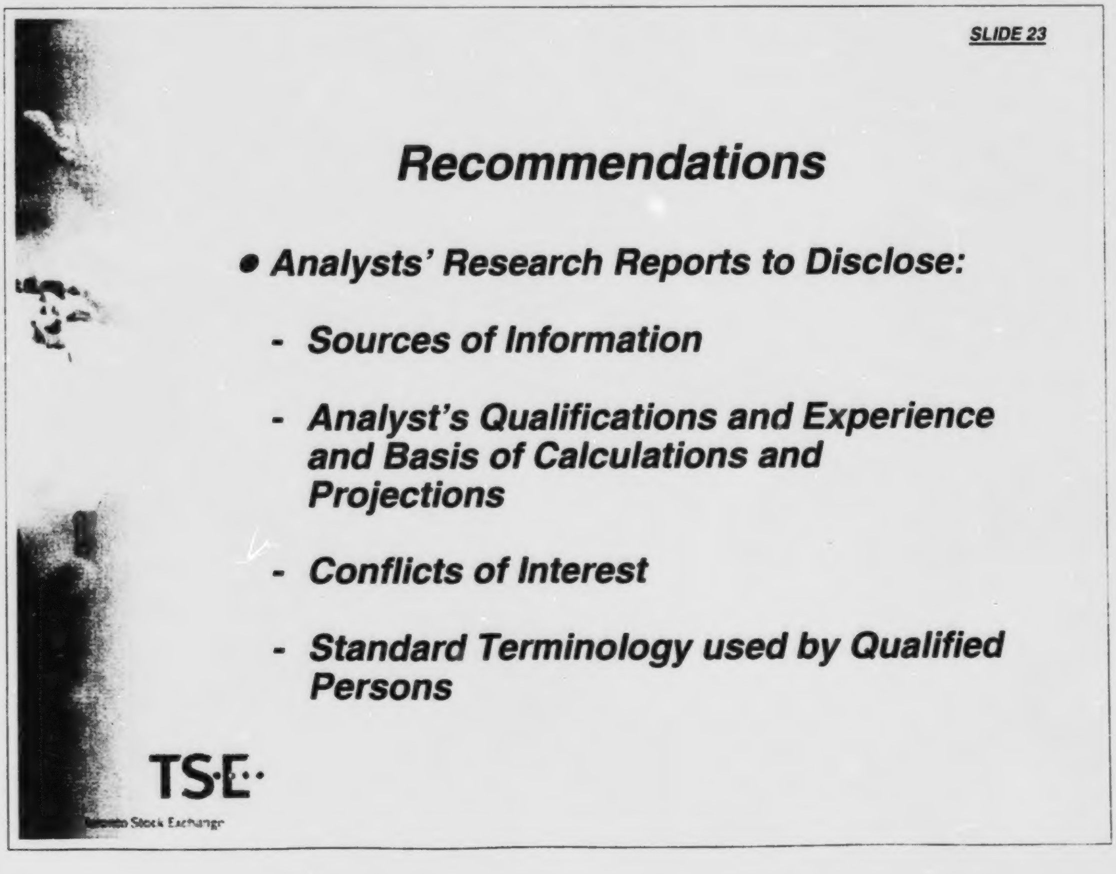
Mining Standards Task Force

Recommendations

- ***The Role of Securities Firms and Research Analysts***
  - ***Analysts to Comply with Code of Ethics***
  - ***Analysts' Research Reports to be Selectively Monitored***
  - ***New Minimum Industry Standards to be Established to Govern Analysts' Conduct***

TSE
Toronto Stock Exchange

AIRD & BERLIS
BARRISTERS & SOLICITORS



Recommendations

- ***Analysts' Research Reports to Disclose:***
  - ***Sources of Information***
  - ***Analyst's Qualifications and Experience and Basis of Calculations and Projections***
  - ***Conflicts of Interest***
  - ***Standard Terminology used by Qualified Persons***

TSE
Toronto Stock Exchange

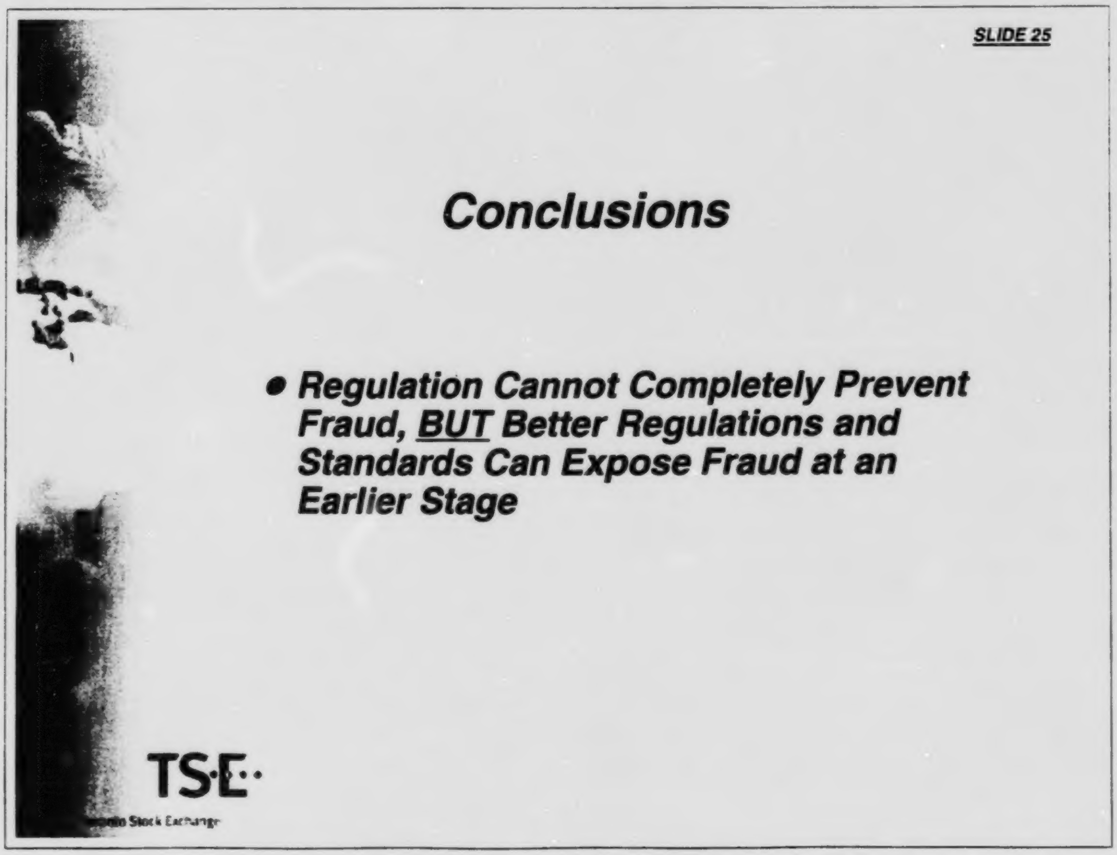
Mining Standards Task Force

Who are the Recommendations aimed at?

- Listed Mining companies
- Stock Exchanges
- Securities Regulators
- Brokerage Firms
- Royal Canadian Mounted Police
- Professional Licensing Associations
- Mining Associations
- Mining Industry and Mining Professionals

TSE
onto Stock Exchange

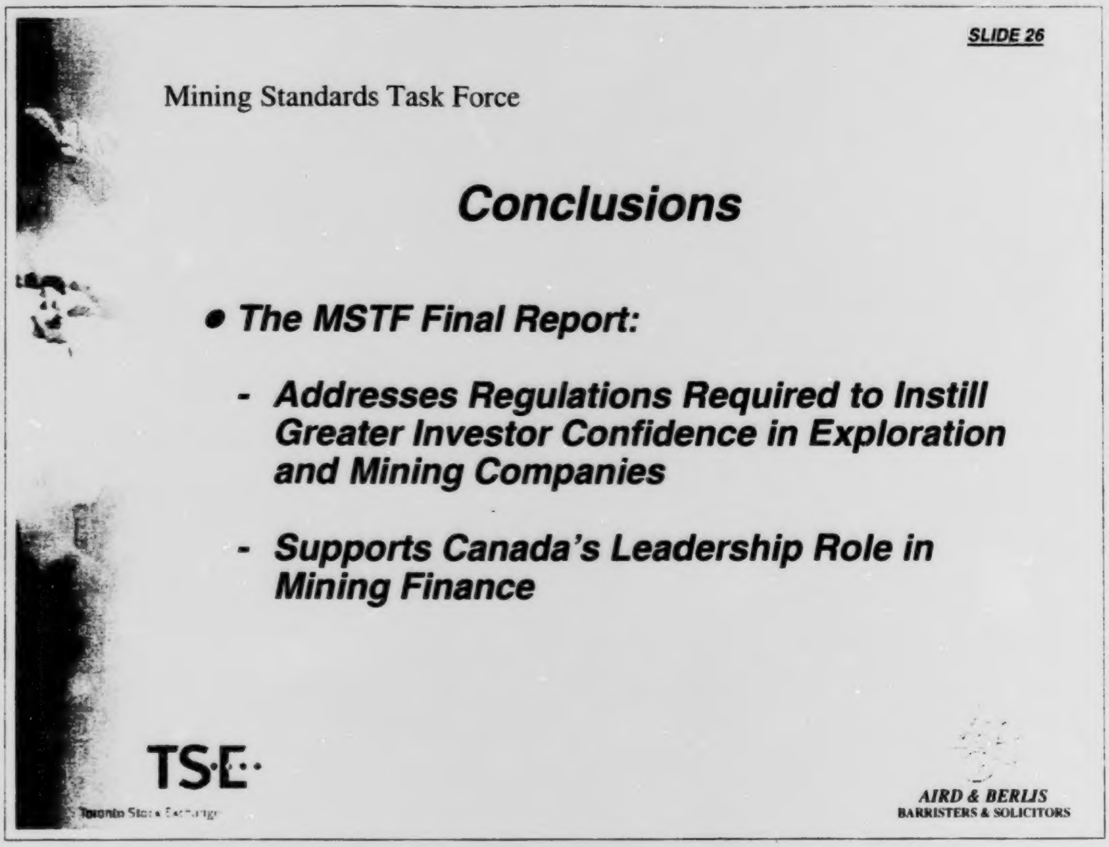
AIRD & BERLIS
BARRISTERS & SOLICITORS



Conclusions

- Regulation Cannot Completely Prevent Fraud, BUT Better Regulations and Standards Can Expose Fraud at an Earlier Stage

TSE
onto Stock Exchange



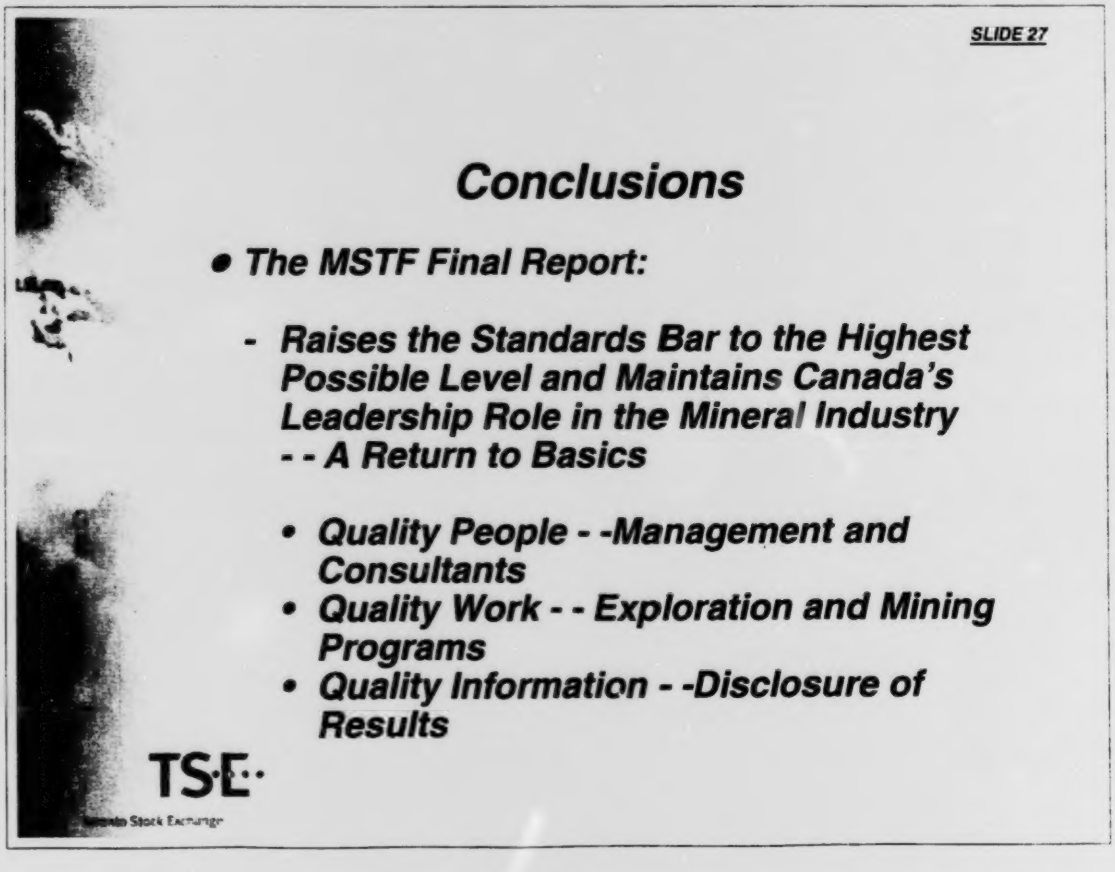
Mining Standards Task Force

Conclusions

- The MSTF Final Report:
  - Addresses Regulations Required to Instill Greater Investor Confidence in Exploration and Mining Companies
  - Supports Canada's Leadership Role in Mining Finance

TSE
Toronto Stock Exchange

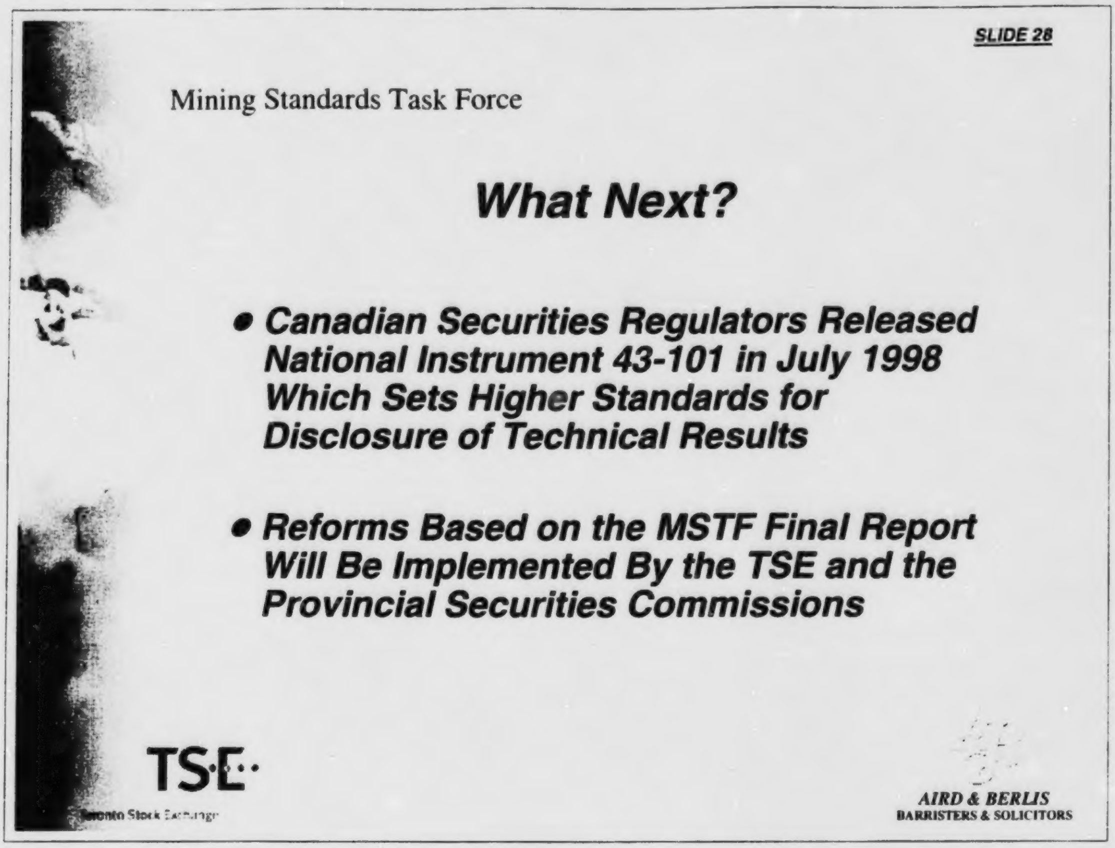
AIRD & BERLIS
BARRISTERS & SOLICITORS



Conclusions

- The MSTF Final Report:
  - Raises the Standards Bar to the Highest Possible Level and Maintains Canada's Leadership Role in the Mineral Industry - - A Return to Basics
    - Quality People - -Management and Consultants
    - Quality Work - - Exploration and Mining Programs
    - Quality Information - -Disclosure of Results

TSE
Toronto Stock Exchange



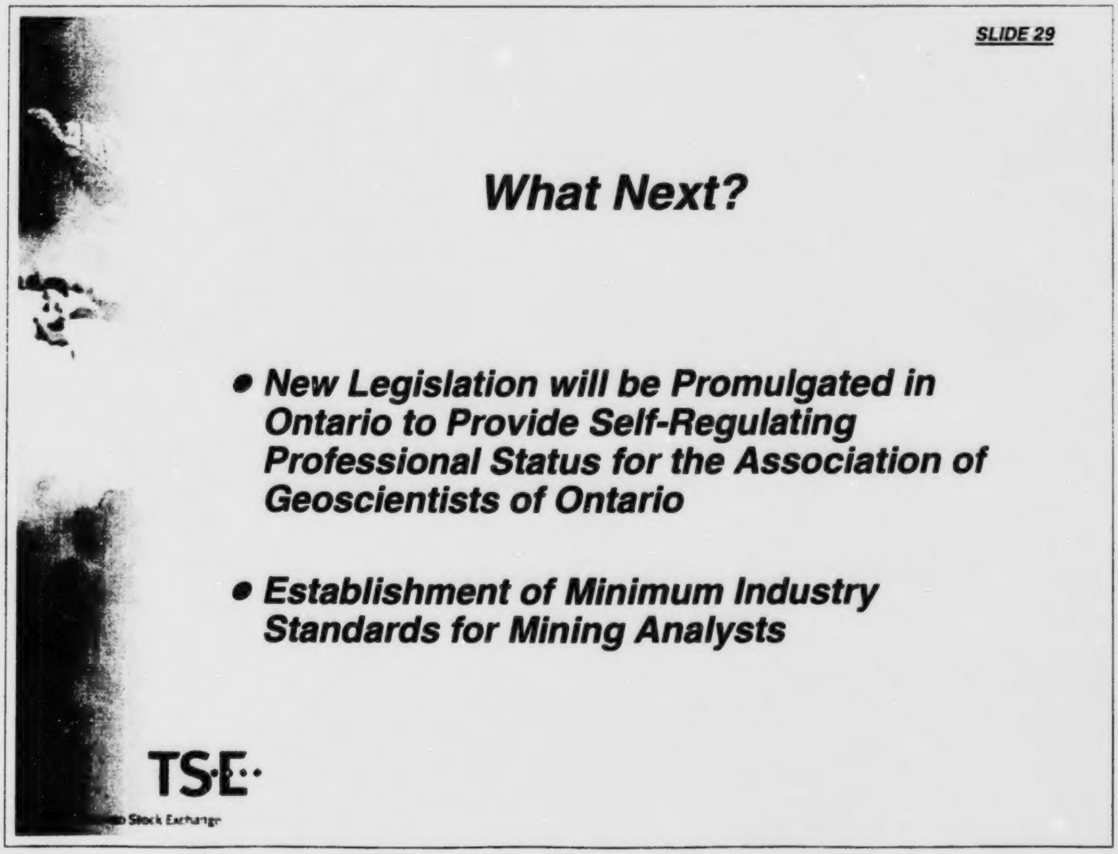
Mining Standards Task Force

What Next?

- Canadian Securities Regulators Released National Instrument 43-101 in July 1998 Which Sets Higher Standards for Disclosure of Technical Results
- Reforms Based on the MSTF Final Report Will Be Implemented By the TSE and the Provincial Securities Commissions

TSE
ronto Stock Exchange

AIRD & BERLIS
BARRISTERS & SOLICITORS



What Next?

- New Legislation will be Promulgated in Ontario to Provide Self-Regulating Professional Status for the Association of Geoscientists of Ontario
- Establishment of Minimum Industry Standards for Mining Analysts

TSE
Stock Exchange

Global Mine Finance - Canada's Dominant Position

Mr. Ernest Nutter
Vice President and Director
Global Metals and Mining Group
RBC Dominion Securities

CANADA: A WINDOW ON GLOBAL MINING
World-Class Technology and Investment Prospects
Canadian Embassy, Tokyo, Japan
February 16, 1999

George Ernest Nutter

Vice President & Director
Global Metals & Mining Group
RBC Dominion Securities

Ernie graduated from Dalhousie University in 1976 with a Bachelor of Science in Geology. He went on to work as an exploration and project geologist with Brascan Resources for twelve years through its evolution into Westmin Resources. Subsequently, Ernie assumed the position of metals and mining analyst for another investment dealer. Ernie also spent two years as Vice President and senior metals and mining analyst with a U.S.-based investment bank before joining RBC Dominion Securities in 1991.

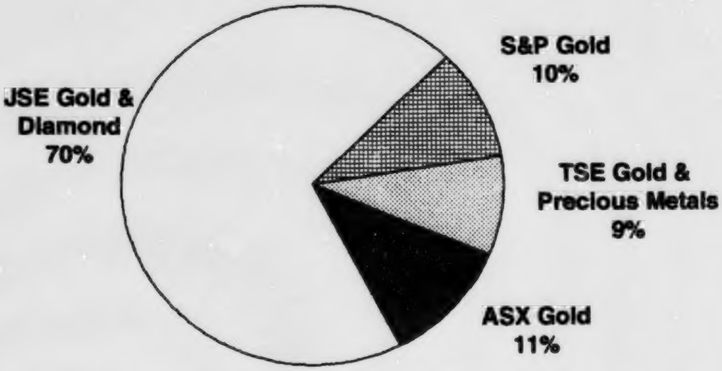
Ernie is both author and co-author of technical and financial publications dealing with uranium exploration and deposit types as well as the uranium market. He has also presented papers on mining finance and a variety of related mining topics to organizations in North America and abroad. Ernie has been ranked as a top mining analyst by institutional investors in each of the last five years, and has been instrumental in expanding our mining research team beyond Canada. Ernie is a Vice President and Director of RBC Dominion Securities and is head of our Global Mining Research Team.

CANADA:
A Window On Global Mining

Global Mining Financing: Canada's
Dominant Role

G. ERNEST NUTTER
Vice-President and Director
Global Metals and Mining Group
RBC Dominion Securities

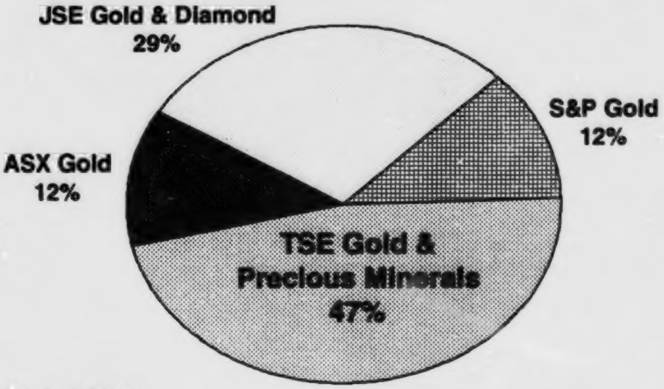
Gold & Precious Metal Indices
1978 Market Capitalization
US$5.8 Billion



Global Metals & Mining

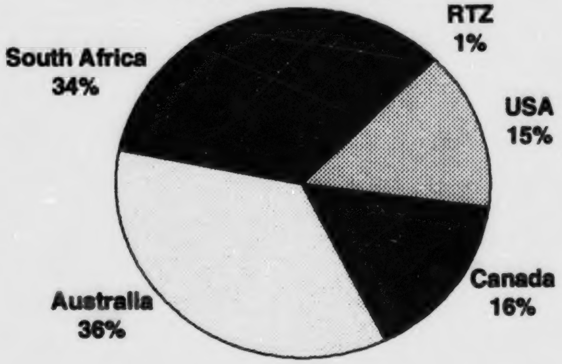
RBC

Gold & Precious Metal Indices
1998 Market Capitalization
US$42.3 Billion



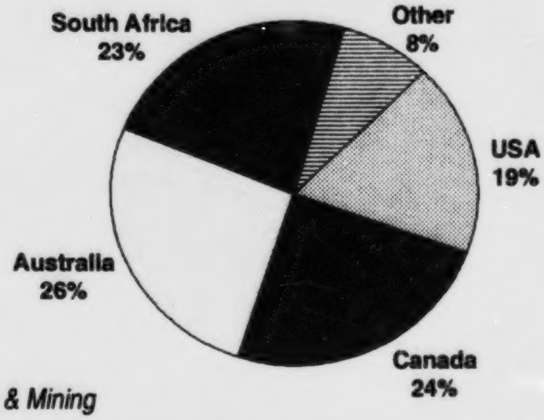
Global Metals & Mining *RBC*

World Mining Indices
1978 Market Capitalization
US$41.7 Billion



Global Metals & Mining *RBC*

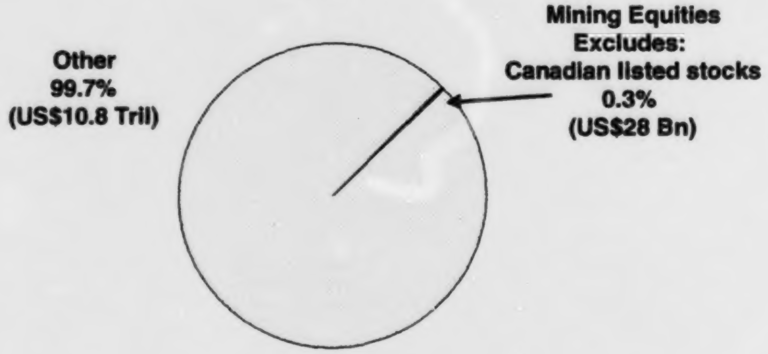
World Mining Indices
1998 Market Capitalization
US$147.6 Billion



The Global Mining Equity Market

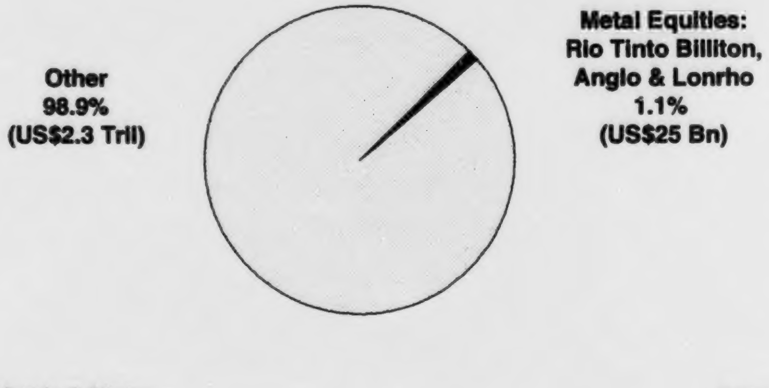
- Over the last two decades Canada's mining industry and mining companies have experienced dramatic growth, largely at the expense of Australia and South Africa
- This trend is expected to continue

S&P 500
1999



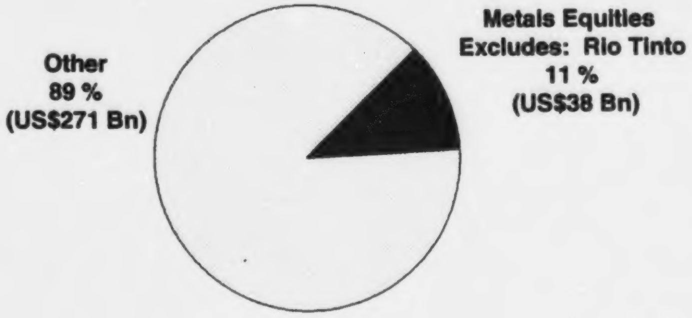
Global Metals & Mining *RBC*

London - FTSE All Share Index
1999



Global Metals & Mining *RBC*

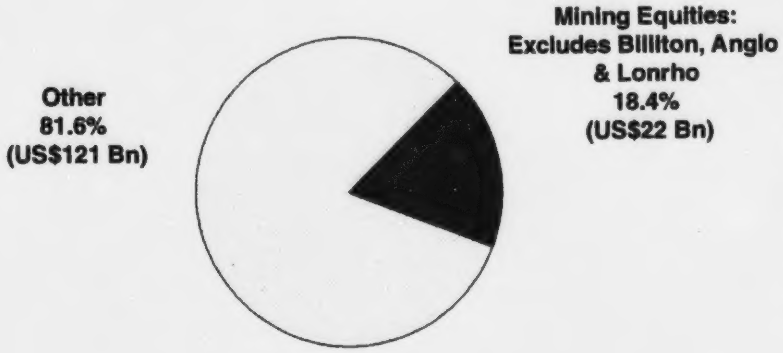
Australia - All Ordinary
1999



Global Metals & Mining

RBC

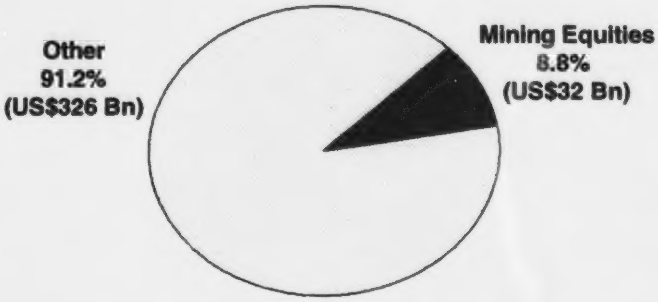
South Africa - Johannesburg All Share Index
1999



Global Metals & Mining

RBC

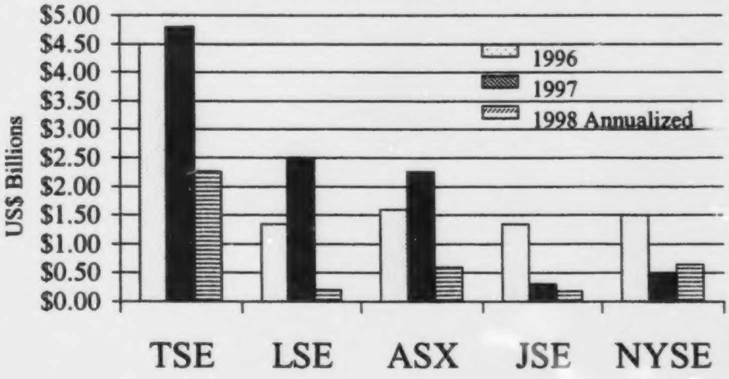
Canada - TSE
1999



Investment Practicalities - Canada

- Canada is home to one of the largest pools of mining capital in the world
- As important as the absolute size of this capital pool is its diversity and its prominence in the Canadian market
- Geography, particularly proximity to the United States and Europe, non-restrictive foreign exchange policies, and acknowledged mining financial and industry expertise, also allow access to large pools of capital outside of the Canadian market

Comparative Market Analysis


Total Equity Financing for Mining Companies US$B

Global Metals & Mining *RBC*

Investment Reality

- Canada has emerged as the new dominant force in global mining development and finance

Global Metals & Mining *RBC*

Summary - Why Canada?

- Mining is a core industry in the Canadian economy
- Mining equities are a dominant and influential sector in the TSE Index
- Performance benchmarking to the TSE 300 Index and Canadian pension regulations, to a large extent limit investment to Canadian domiciled companies
- The above has resulted in the development of the most sophisticated mining investment community in the world and equally prolific development of industry and finance professionals focused on mining

What This Means

- Companies have ready access to the largest and most developed market for mining finance in the world
- Major Canadian projects have been developed and Canadian companies have also emerged as leaders in mining infrastructure worldwide
- Foreign investors, both financial and corporate, increasingly look to Canada to take advantage of the industry and financial expertise in mining

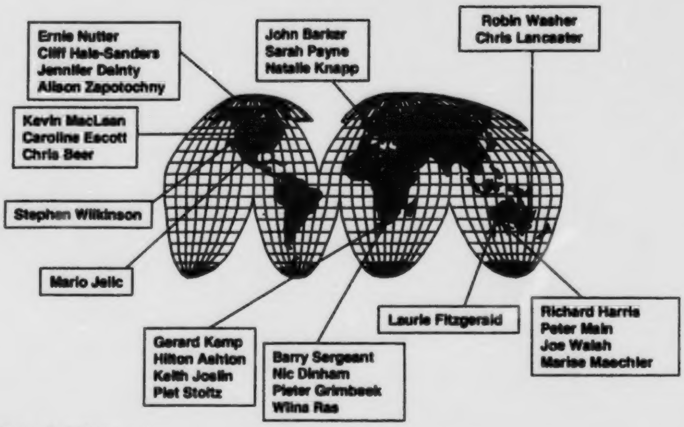
RBC Dominion Securities

- Canada's largest integrated investment and corporate bank
- Canada's leading underwriter of debt and equity over the last five years
- Canada's leading corporate lender
- Dominant Canadian institutional equity and retail presence
- Global "niche" initiatives include Global Fixed Income and Foreign Exchange Division and Global Mining
- A100% owned subsidiary, Canada's largest and the sixth largest bank in North America- assets in excess of $184 Billion

Global Mining - Research

- A Global Focus on the mining industry
- Well regarded and highly ranked research coverage of all major metals and minerals markets
- Over 25 dedicated mining research personnel

Global Metals & Mining Research Team



Ernie Nutter
Cliff Hale-Sanders
Jennifer Dainty
Alison Zapotochny

John Barker
Sarah Payne
Natalie Knapp

Robin Washer
Chris Lancaster

Kevin MacLean
Caroline Escott
Chris Beer

Stephen Wilkinson

Mario Jelic

Gerard Kemp
Hilton Ashton
Keith Joslin
Piet Stoltz

Barry Sergeant
Nic Dinham
Pieter Grimbeek
Wilna Ras

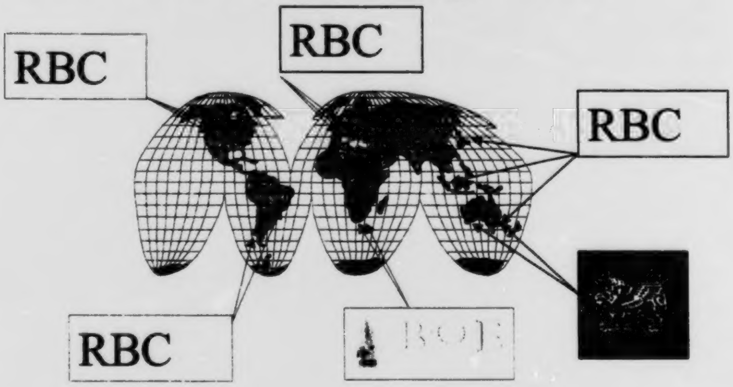
Laurie Fitzgerald

Richard Harris
Peter Main
Joe Walsh
Marise Maechler

Global Mining-Sales/Trading

- Direct specialty access to mining equity markets in Canada, U.S., Europe, Australia, and South Africa through RBC Dominion Securities and associate (partially owned) firms BOE Securities (South Africa) and Hartley Poynton (Australia)
- Specialty institutional equity sales/trading in all markets and resource orientated domestic expertise means distribution power with over 50 Institutional Sales Professionals, over 30 Institutional Traders - strong specialty presence in Europe
- Global execution and distribution capabilities for all mining equities

Global Corporate/Investment Banking & Institutional Mining Team



Global Mining - Investment Banking

- Over a dozen dedicated global mining investment banking personnel
- Supported by the dominant investment banking group in Canada
- Ranked #1 in the world in raising mining equity

Independent Mining Finance Rankings

1997 Mining Equity League Tables ranked by value
Source : *Mining Finance* - June 1998

Company	Rank By Value	No. Deals
RBC Dominion Securities	1	10
UBS	2	3
Robert Fleming	3	3
Nesbitt Burns	4	3
Barclays Capital	5	1
Deutsche MG	6	1
Bear Stearns	7	3
ABN AMRO	8	3
SBC Warburg DR	9	1
CSFB	10	1
Dresdner - KB	11	1
HSBC Investment Bank	12	1
Merrill Lynch	13	1
Scotia Capital Markets	14	2

Corporate Bank - M&A

- One of the largest financiers of resource projects worldwide
- In addition to merger & acquisition expertise in mining investment banking, RBC DS has a dedicated M&A Group of over 30 professionals in Canada and the U.K.
- Since 1990 RBC DS has advised over 300 clients on transactions representing over $100 billion

Why RBC Dominion Securities - Summary

- RBC Dominion Securities has identified mining as a key global niche business and developed independently recognized leadership positions in this industry both domestically and globally
- Foreign investors and companies increasingly look to Canada to participate in this exciting and often highly rewarding industry

We invite you to join them!

Speaking Notes
Yukon Mining Investment for the 21st Century

Honourable Trevor Harding
Minister of Economic Development
Yukon Government

CANADA: A WINDOW ON GLOBAL MINING
World-Class Technology and Investment Prospects
Canadian Embassy, Tokyo, Japan
February 16, 1999

The Honourable Trevor Harding

Government House Leader
Minister of Economic Development
Minister of Public Service Commission
Minister responsible for Yukon Development Corporation
Minister responsible for Yukon Energy Corporation
Minister responsible for Yukon Workers' Compensation Health and Safety Board

MLA - Faro
New Democratic Party

Trevor Harding was born in the south-shore Nova Scotia community of Shelburne on August 20, 1965.

He moved to Faro in 1986 to pursue a summer mining job while working toward a Bachelor of Commerce degree from Acadia University, which he completed in 1991.

Mr. Harding was first elected as MLA for Faro in the general election of October 19, 1992. He is a third-generation politician whose father served in the Nova Scotia Legislature and whose maternal grandfather was a Member of Parliament. He was re-elected as MLA for Faro in the general election of September 30, 1996 and achieved Yukon electoral history be securing 95% of the vote.

In Opposition, Mr. Harding served as critic for Education, Renewable Resources, Economic Development, Workers' Compensation Health and Safety Board, Community and Transportation Services, Tourism and Government Services.

He was appointed to cabinet on October 19, 1997 as the Minister responsible for Economic Development, Public Service Commission, Yukon Energy Corporation, Yukon Development Corporation and the Workers' Compensation Health and Safety Board. He also serves as the Government House Leader.

During his university days, Mr. Harding played as an outside linebacker for the Acadia Axemen. He maintains a keen interest in sports, especially hockey, and pursues a variety of outdoor recreation activities.

Mr. Harding is engaged to Cathy Reynolds, of Whitehorse.

Speaking Notes
Honourable Trevor Harding
Minister of Economic Development
Yukon Government

CANADA: A WINDOW ON GLOBAL MINING
World-Class Technology and Investment Prospects
Canadian Embassy, Tokyo, Japan
February 16, 1999

Introduction

- I would like to thank Natural Resources Canada and the Canadian Embassy for organizing this event and providing me the opportunity to address you this afternoon.

- For many years, we have watched with admiration how the Japanese entrepreneurial spirit has fueled impressive economic growth and there is no doubt that this will occur again in the future.

- We believe in the long term strength of the Japanese market and that much of our future growth will be a result of increased trade with the Pacific Rim.

- That is why our government's economic vision includes establishing long term partnerships to weather any economic crisis and attracting foreign investment to explore and develop our incredible mineral resources.

Yukon's Competitive Advantage

- Despite the temporary downturn in metal prices, our government is confident that mining has a strong future in the Yukon.

- From the Gold Rush a hundred years ago until now, it has and will remain the cornerstone of our economy.

- We want your investment to create jobs and new economic opportunities for Yukon people and our government must now work harder to promote our mineral resources as we compete for scarcer investment dollars.

- In this regard, we offer more competitive advantages than any other northern jurisdiction.

- The Yukon has among the highest mineral potential in North America and we are committed to fostering the responsible development of this resource.

- Outstanding discoveries continued to be found and with the Pogo deposit located in a geological belt that extends into the Yukon, that excitement is now spilling into our territory.

- Our government is a strong supporter of the mining industry.

- In fact, our Government Leader, Piers McDonald, is a former silver miner and in the legislature, I represent a mining community and have also worked at the lead-zinc mine in Faro.

- We are meeting industry's infrastructure needs through capital expenditures that are the highest per capita of any province or territory.

- We have recently announced a mineral exploration tax credit that is the best in Canada and with it, PricewaterhouseCoopers has placed the Yukon as having the second most competitive mining tax regime in Canada, based on mine modeling work.

- And, we are the only jurisdiction without an accumulated debt and we are implementing pay-as-you go budgets.

- Taxes have been frozen so investors and companies will continue to enjoy our competitive corporate and small business tax rates.

Creating Certainty to Protect Investment

- To attract investment, we also know that we must provide a climate of certainty so companies are assured that their investment is protected.

- Our government has made the finalization of land claims a top priority and unlike other jurisdictions, we have established a legally entrenched negotiation process.

- We are working to assume responsibility for mineral resources from the federal government which will allow changes to legislation and the streamlining of the permitting process to better meet industry requirements.

Importance of Partnership

- Our government believes in establishing long term, cooperative relationships and wants to enhance our links with Japanese companies and investors.

- Last fall, we were very pleased to host a delegation representing Japanese mining interests to the Yukon, including Mr. Nomura, Manager for Mitsubishi in Vancouver who is here today.

- We want to encourage more of these visits as we believe our mineral potential and competitive advantages offer opportunities for government and investors to meet mutual goals.

Closing

- Our next presentation from Jesse Duke, Yukon's mining facilitator will demonstrate why the Yukon is among the premier place for mineral investment in North America.

- Yukon's mining industry has a incredible potential and we invite you to become part of it.

- I look forward to building to new partnerships and working with you in near future.

- Thank you.

Yukon Mining Investment for the 21st Century

Mr. Jesse Duke
Mining Facilitator and Special Acting Director
Mines and Development Division
Minister of Economic Development
Yukon Government

CANADA: A WINDOW ON GLOBAL MINING
World-Class Technology and Investment Prospects
Canadian Embassy, Tokyo, Japan
February 16, 1999

Mr. Jesse Duke

Mining Facilitator and Special Acting Director,
Mines and Resource Development Division,
Department of Economic Development

Jesse has been a Yukon resident for 25 years. He holds a Bachelor of Science degree in Geology and studies at the University of Alaska and the University of British Columbia.

He is a member of the Society of Professional Engineers and Geoscientists of British Columbia.

Jesse has worked extensively in the exploration industry throughout the Yukon, northern British Columbia and Alaska. He joined government and has been the Yukon Mining Facilitator since 1993. He is presently also acting Director of Mineral Resources.

Yukon Mining Investment for the 21st Century

Mr. Jesse Duke
Mining Facilitator

Tokyo, Japan
February 1999

Prepared by
Economic Development,
Mineral Resources

Yukon
Economic Development

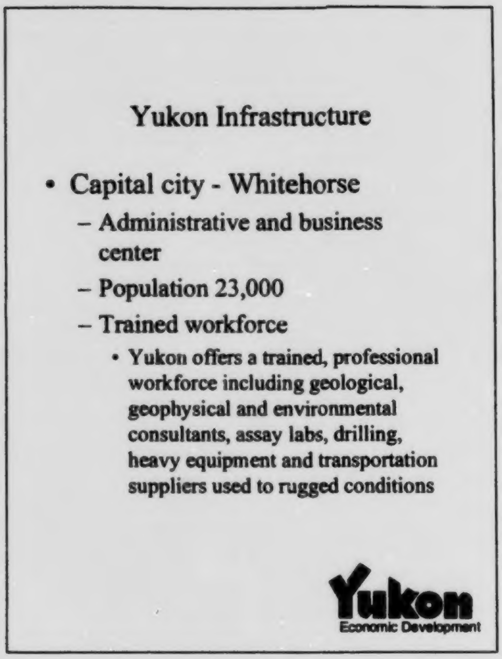
There Is Gold...
and Much More...

- Location and infrastructure
- Well located in the pacific rim
- Outstanding geological potential
- Supportive government
- 100 years of mining tradition
- Very favorable taxes and incentive programs compared to other jurisdictions

Yukon
Economic Development

One hundred years ago, thousands of people from all over the world dropped everything and headed for the Klondike , starting the gold rush of 1898. Mining opened up the Yukon to the world and mining continues to be the single most important sector of the Yukon's economy. Today, gold still attracts exploration companies with the additional lure of silver, zinc, copper, coal and tungsten.

Yukon's unique geology provides a variety of deposit types with good potential for new discoveries. Yukon has a stable political climate supportive of mining and infrastructure built to serve the mining industry.



Yukon Infrastructure

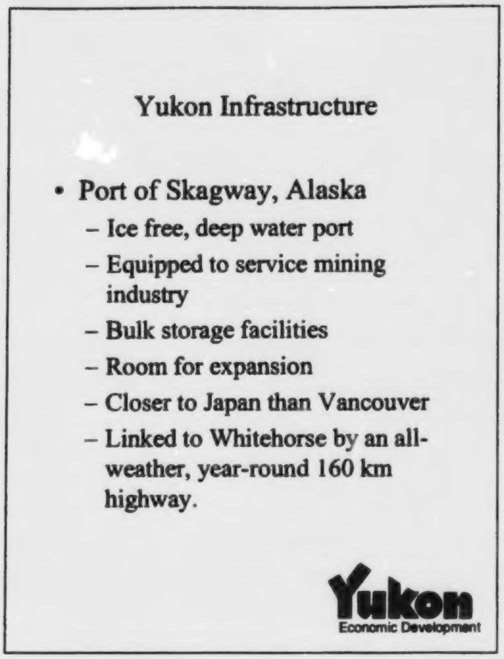
- Capital city - Whitehorse
  - Administrative and business center
  - Population 23,000
  - Trained workforce
    - Yukon offers a trained, professional workforce including geological, geophysical and environmental consultants, assay labs, drilling, heavy equipment and transportation suppliers used to rugged conditions

Yukon
Economic Development

The Yukon has a population of 33,500, of which 23,000 live in the capital city of Whitehorse. All government services, industry support services and modern amenities are available in Whitehorse, including year-round daily jet service to Vancouver, with regular regional air service to most communities, Alaska and the Northwest Territories.

The population is stable and is among the best-educated workforce in Canada. Recreational and educational opportunities as well as range of services available exceed those typically found in a community of this size. There is a community college, an arts centre and several sports recreational facilities.

The business of mineral exploration and production has been the most significant non-government economic force in the Yukon for over 100 years. Over the recent period 1986 to 1997, the mining sector accounted for as much as 28% of the Yukon Gross Domestic Product. For this reason, infrastructure, support services and trained population are geared towards supporting the mining industry.

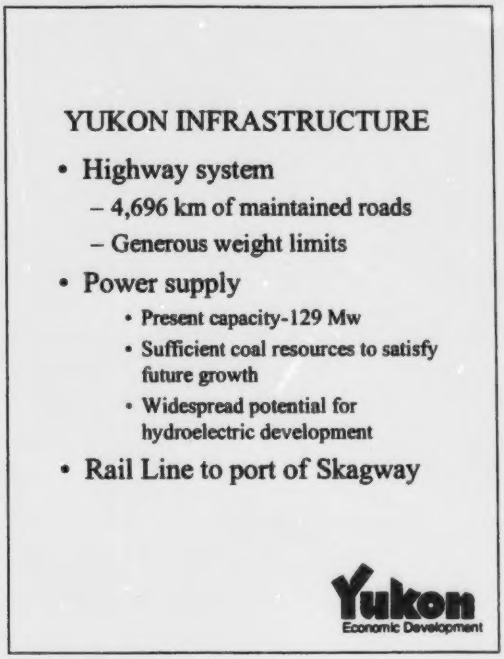


Yukon Infrastructure

- Port of Skagway, Alaska
  - Ice free, deep water port
  - Equipped to service mining industry
  - Bulk storage facilities
  - Room for expansion
  - Closer to Japan than Vancouver
  - Linked to Whitehorse by an all-weather, year-round 160 km highway.

Yukon
Economic Development

Located only 160 km from Whitehorse by an all-weather road, the port of Skagway, located in Alaska, is a deep-water, ice-free year round port. It is designed and equipped to handle out-bound ore concentrates from Yukon mines. Water depth is 12.8 metres at the dock face; the docks are commonly used by panamax ships. Facilities include a 10,000 m3 ore concentrate storage warehouse and 100,000 m3 of open storage. The port of Skagway is 760 kilometres closer to Japan than the port of Vancouver is.



YUKON INFRASTRUCTURE

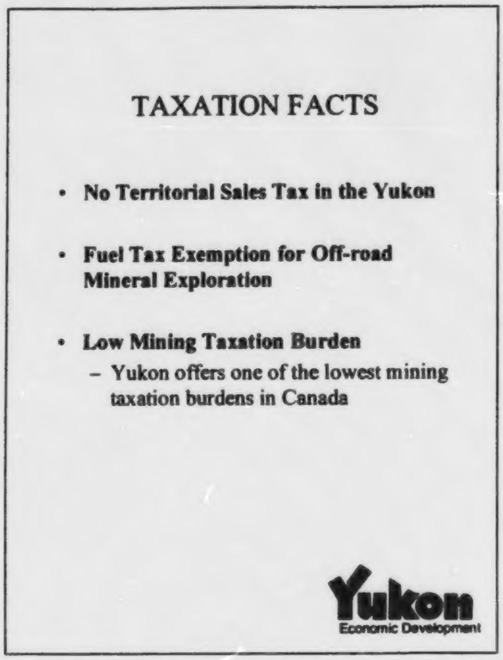
- Highway system
  - 4,696 km of maintained roads
  - Generous weight limits
- Power supply
  - Present capacity-129 Mw
  - Sufficient coal resources to satisfy future growth
  - Widespread potential for hydroelectric development
- Rail Line to port of Skagway

Yukon
Economic Development

The Yukon highway system is designed and maintained to accommodate bulk loads up to 77,000 kilograms. Key transportation routes are paved, including the major concentrate haul road to Skagway.

The total capacity of the Yukon electrical power system is 129 Megawatts. Energy is now provided by two hydro dam facilities augmented by diesel as required. In addition, numerous watersheds have been identified as good sites for future hydroelectric development.

There is a narrow gauge rail between Whitehorse and Skagway. It offers an alternative to highway transportation as new export markets for ore concentrates and coal are developed.



TAXATION FACTS

- **No Territorial Sales Tax in the Yukon**
- **Fuel Tax Exemption for Off-road Mineral Exploration**
- **Low Mining Taxation Burden**
  - Yukon offers one of the lowest mining taxation burdens in Canada

Yukon
Economic Development

Within Canada, Yukon has a competitive tax regime all federal tax benefits apply. In addition Yukon offers no territorial sales tax, no territorial tax on minesite fuel consumption and a competitive tax rate.

The government recently announced a refundable tax credit of 22 % on eligible expenditures to encourage exploration

TAXATION FACTS

In 1997 Pricewaterhouse Coopers ‘s "Canadian Mining Taxation" guide rated Yukon as the third best jurisdiction regarding total mining taxation burden.

In 1999, We asked for an update taking into account amendments to the mining taxation regimes in N.W.T., B.C., Newfoundland and Yukon (22% refundable mineral exploration tax credit).

Yukon rated as having the second lowest mining taxation burden in Canada.

Yukon
Economic Development

Every three years, PricewaterhouseCoopers produces a "Canadian Mining Taxation" publication. In their latest release, in 1997, Yukon rated as third best jurisdiction regarding total mining taxation burden.

In 1999, we asked PricewaterhouseCoopers to update their mining taxation model to take into account actual and proposed amendments to the mining taxation regimes in N.W.T., B.C., Newfoundland and Yukon (20% refundable mineral exploration tax credit). After the model was revised, Yukon rated as having the second lowest mining taxation burden in Canada. At the time we requested this update, the proposed refundable Yukon mineral exploration tax credit was 20%. The tax credit is actually is slightly higher, at 22%.

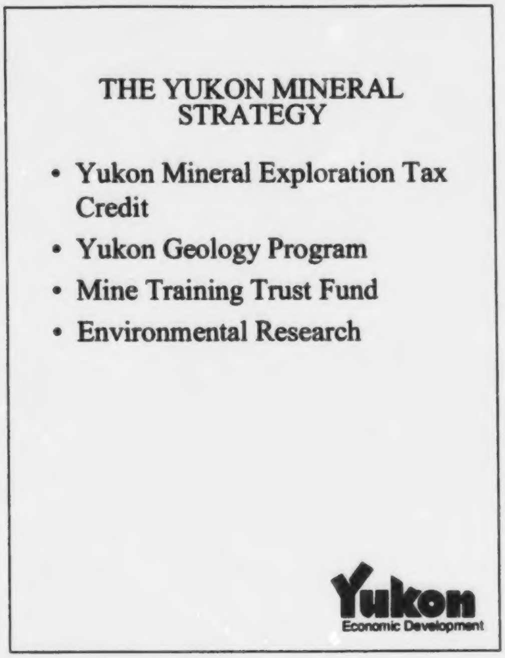
YUKON GOVERNMENT POLICIES AND ACTIONS

- The Yukon Mineral Strategy will ensure the development of a profitable and environmentally responsible mining industry
- Together with other incentive programs, the Yukon Mineral Strategy makes investment dollars go farther than in most other jurisdictions

Yukon
Economic Development

The Yukon Government plays an important role to encourage mining development in the Yukon. All major mining developments in the past have received assistance in the development of the necessary infrastructure to ensure their success. Transport regulations provide for highway load limits up to 77,000 kilograms to facilitate the export of ore concentrate. Apprenticeship and other training programs are in place to assist companies in finding a local stable work force.

Yukon government is committed to building a stable, profitable and environmentally responsible industry. To do so, Yukon government has prepared a YUKON MINERAL STRATEGY. Some of these components are already in place, other will be implemented in 1999.



THE YUKON MINERAL
STRATEGY

- Yukon Mineral Exploration Tax Credit
- Yukon Geology Program
- Mine Training Trust Fund
- Environmental Research

Yukon
Economic Development

The Yukon Mineral Exploration Tax Credit

Ensuring a competitive Tax regime: Yukon Mineral Exploration Tax Credit will provide a refundable tax credit equal to 22% of qualifying exploration expenditures incurred by eligible individuals or corporations conducting mineral exploration in Yukon. This credit was just announced in Vancouver at the Cordilleran Round Up Conference and received a very positive response from industry.

The Yukon Geology Program provides comprehensive information to industry on the geology, geochemistry and mineral deposits in the Yukon. The information and expertise of the geologists on staff are available to mining industry. Approximately 20 staff members are totally dedicated to the productions of maps, reports and data of service to the mining industry. Yukon has one of the most comprehensive publicly available computerized databases for industry use.

The **Mine Training Trust Fund**: A mine training trust fund has been created to ensure that trained local labor force is available to mining companies.

Mining Environment Research

The Yukon Government along with the Federal Government, First Nations and local non-government organizations fun research to better understand issues surrounding mining and the environment.

THE YUKON MINERAL STRATEGY

Effective Incentive Programs

- Yukon Industrial Support Policy
- Energy Infrastructure Loans for Resources Development Program
- Yukon Mining Incentive Program
  - *Up to $20,000 in government grants available for grass-roots exploration projects with budgets of up to $100,000 or less.*

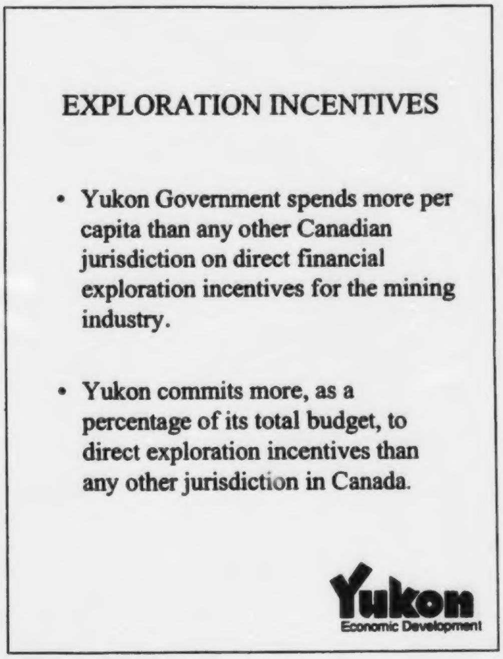
Yukon
Economic Development

Effective Incentive Programs

The Yukon Industrial Support Policy recognizes low density of infrastructure and may enter into agreement with development to share the cost of road development or improvement, energy supply or training programs.

The **Energy Infrastructure Loans for Resource Development Program** assist the development sector by helping defer the capital cost of building energy infrastructure.

The **Yukon Mining Incentive Program** is designed to promote and enhance mineral prospecting, exploration and development activities in the Yukon. The program provides a portion of the risk capital required to locate and explore mineral deposits. Three levels of activities are eligible for thee types of funding, ranging from $10,000 to $20,000 depending on the size and type of projects.



EXPLORATION INCENTIVES

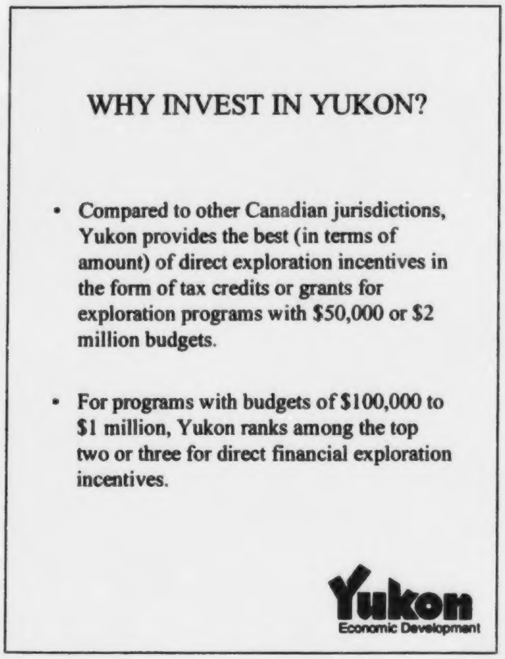
- Yukon Government spends more per capita than any other Canadian jurisdiction on direct financial exploration incentives for the mining industry.
- Yukon commits more, as a percentage of its total budget, to direct exploration incentives than any other jurisdiction in Canada.

Yukon
Economic Development

Yukon Government spends more per capita than any other Canadian jurisdiction on direct financial exploration incentives for the mining industry.

The direct exploration incentive funding per capita is the highest in the country.

There is a strong commitment from the Yukon Government to exploration. Yukon commits more, as a percentage of its total budget, to direct exploration incentives than any other jurisdiction in Canada.



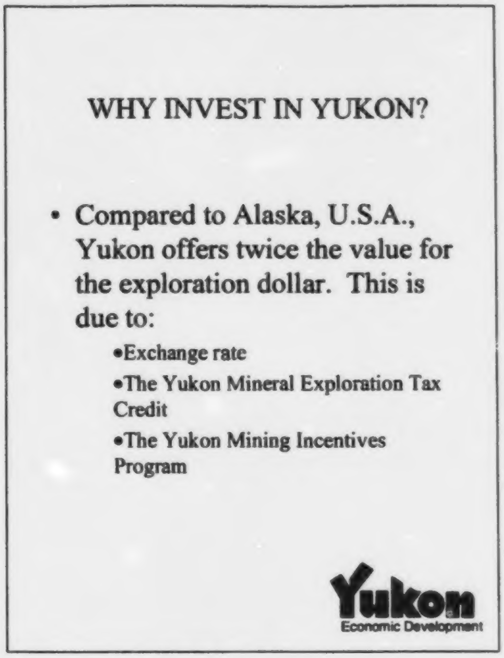
WHY INVEST IN YUKON?

- Compared to other Canadian jurisdictions, Yukon provides the best (in terms of amount) of direct exploration incentives in the form of tax credits or grants for exploration programs with $50,000 or $2 million budgets.
- For programs with budgets of $100,000 to $1 million, Yukon ranks among the top two or three for direct financial exploration incentives.

Yukon
Economic Development

Compared to other Canadian jurisdictions, Yukon provides the best (in terms of amount) of direct exploration incentives in the form of tax credits or grants for exploration programs with $50,000 or $2 million budgets.

For programs with budgets of $100,000 to $1 million, Yukon ranks among the top two or three for direct financial exploration incentives.

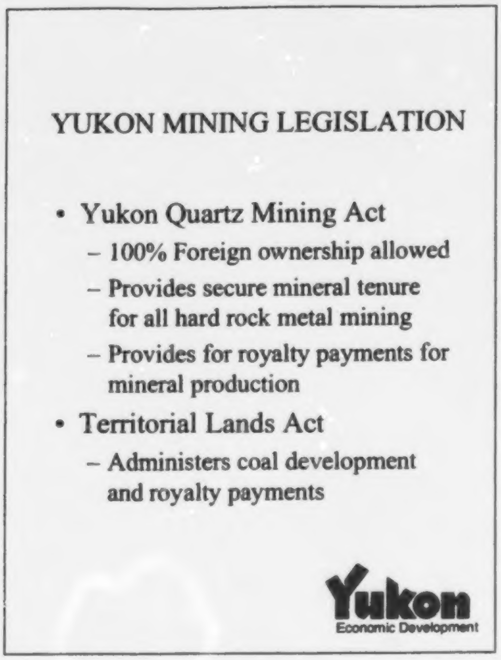


WHY INVEST IN YUKON?

- Compared to Alaska, U.S.A., Yukon offers twice the value for the exploration dollar. This is due to:
  - Exchange rate
  - The Yukon Mineral Exploration Tax Credit
  - The Yukon Mining Incentives Program

Yukon
Economic Development

Your exploration dollars go farther in Yukon then in Alaska.



YUKON MINING LEGISLATION

- Yukon Quartz Mining Act
  - 100% Foreign ownership allowed
  - Provides secure mineral tenure for all hard rock metal mining
  - Provides for royalty payments for mineral production
- Territorial Lands Act
  - Administers coal development and royalty payments

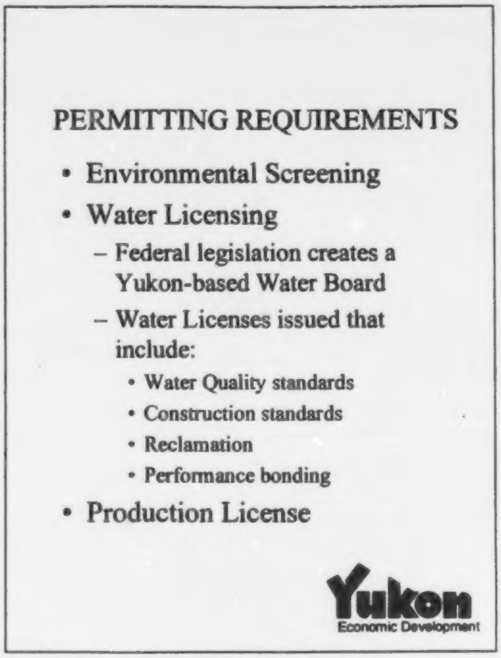
Yukon
Economic Development

Mineral, land and water resources are administered in the Yukon by the Federal Government under federal legislation by the Department of Indian and Northern Affairs. Negotiations for the transfer of these responsibilities to the Yukon Government are presently underway and should result in the transfer of these responsibilities in the near future. The Yukon Government intends to facilitate a smooth transition by ensuring the existing federal legislation governing mining remains in place when the transfer occurs.

Hard rock mineral resources are administered under the Yukon Quartz Mining Act. This legislation allows for foreign acquisition of mineral title. Once acquired, mineral tenure is secure. Royalty rates for hard rock mining are complex and based on profit, not production.

Obtaining mineral rights is a simple process involving staking a claim. To maintain ownership, a minimum $100 expenditure per claim per year is required. Work conducted on the claim is usually submitted to the government to satisfy this requirement. The information is held on a confidential basis while the claims are maintained. Each claim covers 206,000 square metres. There is no limit to the number of claims that may be held. The legislation permits a claim to be converted to a 21 year renewable lease. This is a common practice where a mineral resource is identified.

Regulations to control exploration activities on mining claims are now in place and will be implemented in summer 1999. The mining community contributed to the building of this legislation and has endorsed it.

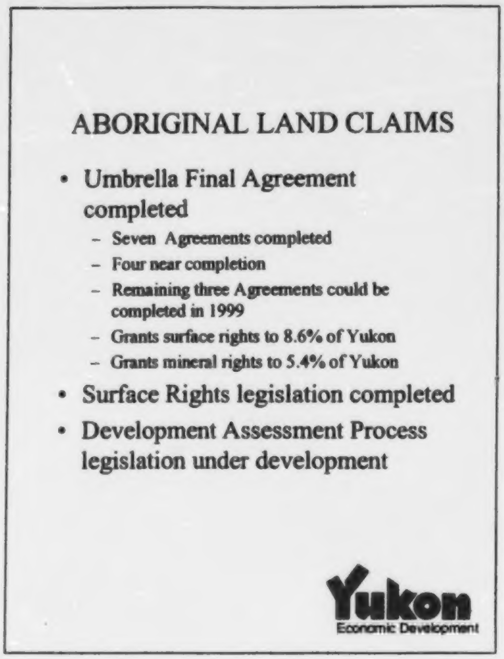


PERMITTING REQUIREMENTS

- Environmental Screening
- Water Licensing
  - Federal legislation creates a Yukon-based Water Board
  - Water Licenses issued that include:
    - Water Quality standards
    - Construction standards
    - Reclamation
    - Performance bonding
- Production License

Yukon
Economic Development

The Federal Government is required to conduct environmental screening on mining development projects to determine possible negative environmental impacts and recommend ways to mitigate those impacts. Meetings take place directly with the company to discuss specific technical aspects, a screening report is issued that recommends how the project can proceed. The company may then submit an application for a water use license and a production license. No metal mining project has been refused in the Yukon

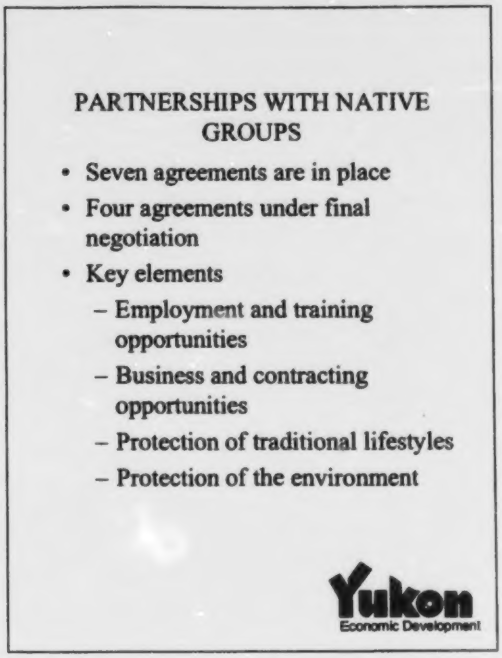


ABORIGINAL LAND CLAIMS

- Umbrella Final Agreement completed
  - Seven Agreements completed
  - Four near completion
  - Remaining three Agreements could be completed in 1999
  - Grants surface rights to 8.6% of Yukon
  - Grants mineral rights to 5.4% of Yukon
- Surface Rights legislation completed
- Development Assessment Process legislation under development

Yukon
Economic Development

The Yukon is at an advanced stage in settling outstanding native land claims. With the passage of the Umbrella Final Agreement into legislation in 1997, the framework is in place to finalize land selections and self-government agreements with the First Nations by the end of 1999. Seven out of fourteen agreements have been settled, and four are very near completion. The Umbrella Final Agreement provided for Surface Rights Legislation. This is now in place and provides a mechanism to resolve disputes over access rights. Development Assessment Process legislation is now under development and once in place will govern how environmental screenings are conducted on all Yukon lands. This legislation should be ready in 1999.



PARTNERSHIPS WITH NATIVE GROUPS

- Seven agreements are in place
- Four agreements under final negotiation
- Key elements
  - Employment and training opportunities
  - Business and contracting opportunities
  - Protection of traditional lifestyles
  - Protection of the environment

Yukon
Economic Development

Partnerships with Native Groups

Native groups have demonstrated that they are willing to work with mining companies and support their projects in exchange for the consideration of benefits to the local community. Five agreements have been achieved with six different native groups. Several mining companies are presently engaged in negotiations. It is important to note that final resolution of land claims has not been a condition for establishing a successful working relationship between the local first nation and a mining company. Native corporations have already been eager to assist in the construction and supply of existing mining operations and promising exploration programs on a competitive basis. Recognition and protection of traditional native lifestyles, employment and training opportunities and equity participation, such as stock options, are some of the elements discussed in these negotiations.

THE TINTINA GOLD BELT

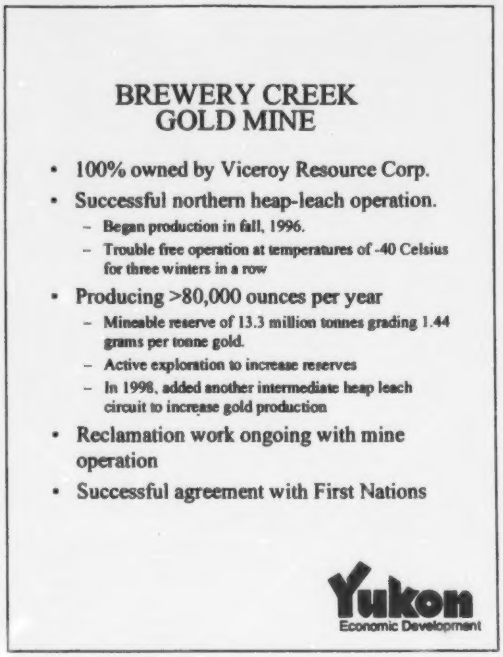
- A new exploration target
- The Tombstone Plutonic Suite
- Rich in gold, silver, tin, tungsten and molybdenum
- Extends across central Yukon
- 3 producing gold mines
- 30 million ounces of gold produced, 40 million in reserve
- Many promising properties

Yukon
Economic Development

The recent discovery in Alaska of the Pogo deposits has focussed new interest on a belt of rocks running between Alaska and the Northwest Territories.

These gold-rich mineral deposits and occurrences span greater than 550 km between Dawson City and MacMillan Pass at the NWT border. The occurrences are largely centered around the more than 110 stocks and plutons that string across the region. The plutonic rocks are part of the mid-Cretaceous (~92 Ma) Tombstone Plutonic Suite and are considered to be the mineralizers. The Tintina Gold Belt covers most of central Yukon and adjacent Alaska. This belt has over 30 million ounces of past gold production, an additional 40 million ounces in reserve and resource categories, three producing gold mines, including the Brewery Creek mine near Dawson and the Dublin Gulch property near Mayo, and at least four recent, large discoveries which are moving towards production. Several large deposits in Alaska have been found within this geological zone; for instance the high-tonnage, low-grade gold deposit of the Fort Knox mine near Fairbanks.

Virtually all the gold deposits in the Tintina Gold Belt have a very close relationship with the Tombstone Intrusion Suite. The very high potential of these rocks has initiated a rush of reconnaissance level exploration by junior and major companies in 1998.



BREWERY CREEK GOLD MINE

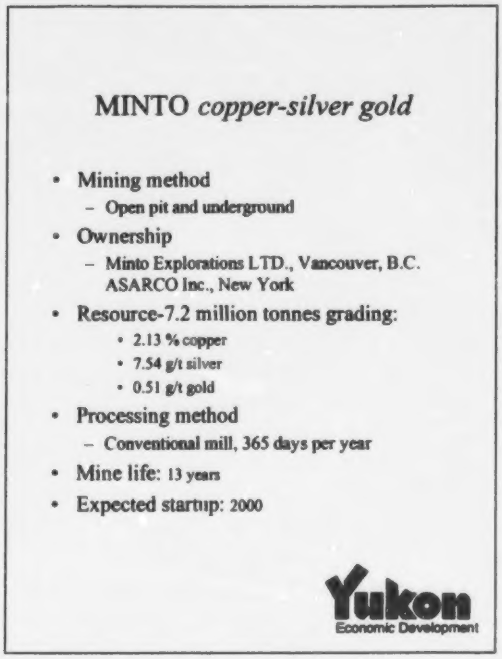
- 100% owned by Viceroy Resource Corp.
- Successful northern heap-leach operation.
  - Began production in fall, 1996.
  - Trouble free operation at temperatures of -40 Celsius for three winters in a row
- Producing >80,000 ounces per year
  - Mineable reserve of 13.3 million tonnes grading 1.44 grams per tonne gold.
  - Active exploration to increase reserves
  - In 1998, added another intermediate heap leach circuit to increase gold production
- Reclamation work ongoing with mine operation
- Successful agreement with First Nations

Yukon
Economic Development

Brewery Creek is owned and operated by Vancouver-based Viceroy Resource Corp. The mine is located 57 km east of Dawson City in central Yukon. This operation represents the Yukon's first open pit heap-leach gold mine and is expected to produce 80,000 to 100,000 ounces of gold per year. Continued success at this mine has proven for the third winter in a row that low-cost heap leaching can be used effectively in the Yukon.

Brewery Creek's expected production for 1998 is 80,000 ounces. In 1998, an additional intermediate leach circuit which doubles the solution handling capacity was installed. Viceroy has incorporated recontouring and reclamation of waste piles in their operations. As the potential for, and interest in this kind of deposit is new to the Yukon, and there are large areas of favorable geological environments, we expect further discoveries and development of low-grade bulk tonnage deposits, particularly in the Tintina Gold Belt.

Last fall, in October 1998, a delegation of Japanese business men from Sumitomo Metal Mining Canada, Mitsubishi Material Corp., Dowa Mining Co., Sumito Canada, the Metal Mining Agency of Japan and the Consul for Economic Affairs at the Consulate General of Japan in Vancouver, toured some of Yukon mining projects. The Japanese delegation visited this mine and several others.



MINTO *copper-silver gold*

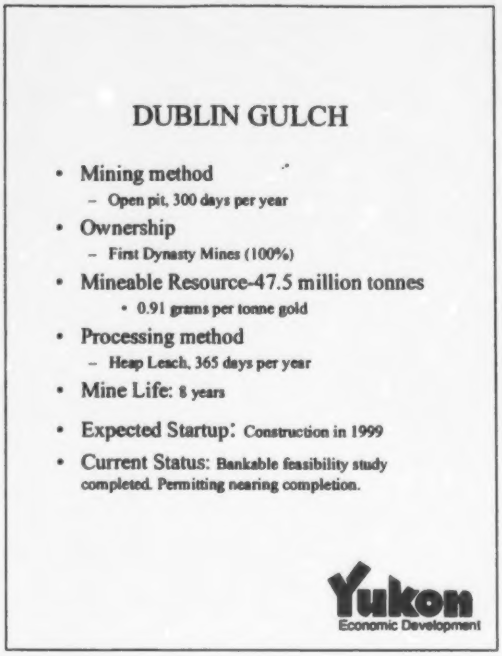
- Mining method
  - Open pit and underground
- Ownership
  - Minto Explorations LTD., Vancouver, B.C.
    ASARCO Inc., New York
- Resource-7.2 million tonnes grading:
  - 2.13 % copper
  - 7.54 g/t silver
  - 0.51 g/t gold
- Processing method
  - Conventional mill, 365 days per year
- Mine life: 13 years
- Expected startup: 2000

Yukon
Economic Development

Minto Property

The copper-silver-gold Minto property is located 240 km north of Whitehorse. Mineable reserves are 7.2 million tonnes grading 2.13% copper, 7.54 g/t silver and 0.51 g/t gold. A positive feasibility study has been completed. The deposit would initially be mined by open pit methods, followed by underground room and pillar methods. A 1360 tonne per day mining and milling operation to produce 23,000 tonnes of copper concentrate per year is planned. The ore would be processed by conventional milling. Metallurgical testing showed copper recoveries at 95%, gold recoveries at 75% and silver recoveries of 85%. Sufficient reserves have been identified for a 12 year mine life.

Concentrate will be trucked on a daily basis to Skagway or Fort Nelson. Start up of operations is expected early in 2000. Low copper prices are now the main deterrent to production. The potential to identify additional reserves is considered good. A socio-economic agreement with the Selkirk First Nations has been signed. The project has cleared the environmental screening process and a signed water license is in place.



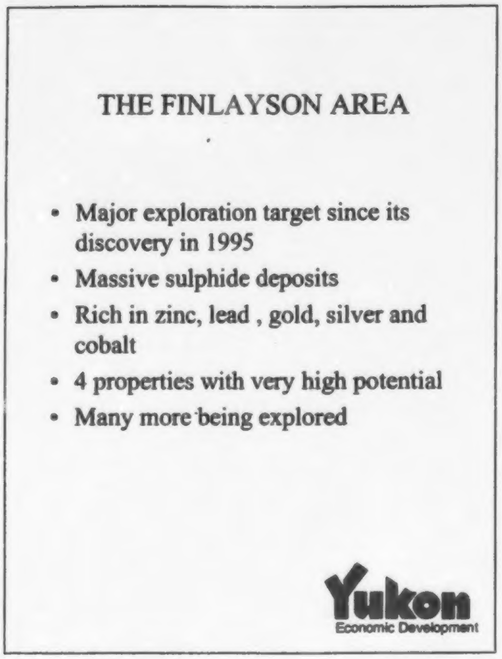
DUBLIN GULCH

- Mining method
  - Open pit, 300 days per year
- Ownership
  - First Dynasty Mines (100%)
- Mineable Resource-47.5 million tonnes
  - 0.91 grams per tonne gold
- Processing method
  - Heap Leach, 365 days per year
- Mine Life: 8 years
- Expected Startup: Construction in 1999
- Current Status: Bankable feasibility study completed. Permitting nearing completion.

Yukon
Economic Development

Dublin Gulch

The Dublin Gulch project is located 40 km northeast of Mayo. A mineable reserve consisting of 47.5 million tonnes grading 0.91 g/t gold has been defined. A 20,000 tonne per day open pit mining operation with a mine life of 8 years and a 1 to 1 stripping ratio is planned. Gold recoveries utilizing a cyanide heap leach process are estimated at 79.6%. The Eagle ore body on the Dublin Gulch property contains 1.51 million ounces of gold in the proven and probable category. Rescan Engineering has completed a bankable feasibility study on the projects which envisages a $106 million U.S. open pit heap leach operation, producing 135,000 ounces per year of gold. The permitting for the project is nearing completion. An framework agreement with the First Nations of the areas has been signed. This property is accessible by road and could use Skagway as transportation link.



THE FINLAYSON AREA

- Major exploration target since its discovery in 1995
- Massive sulphide deposits
- Rich in zinc, lead , gold, silver and cobalt
- 4 properties with very high potential
- Many more being explored

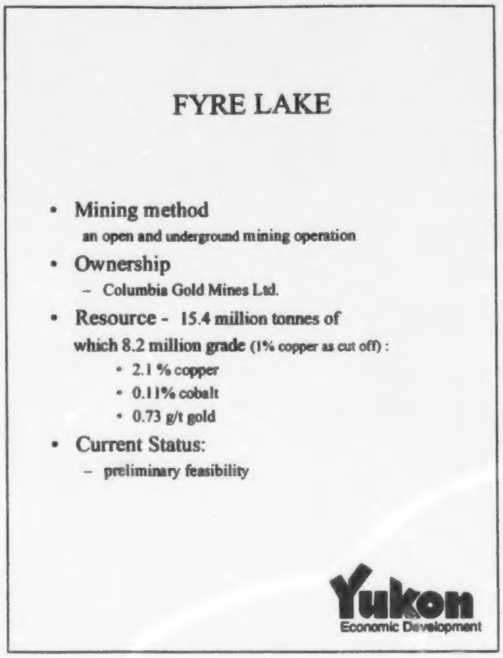
Yukon
Economic Development

Finlayson Area

This area, in south eastern Yukon has also attracted a lot of interest. West and north of Watson Lake, follow-up work on an anomalous government regional geochemical sample led to an exciting series of discoveries of volcanogenic massive sulphide deposits, spurring an exploration boom from 1995 to 1997.

These volcanogenic massive sulphide deposits occur in a belt of interlayered mafic and felsic Devonian and Mississippian metavolcanic and metasedimentary rocks. The massive sulphide potential of this belt was not widely recognized prior to these discoveries.

Four deposits have been discovered to date include Kudz Ze Kayah, owned by Cominco containing 11.3 million tonnes of 0.93% copper, 1.5% lead, 5.9% zinc and 1.34 grams per tonne gold.



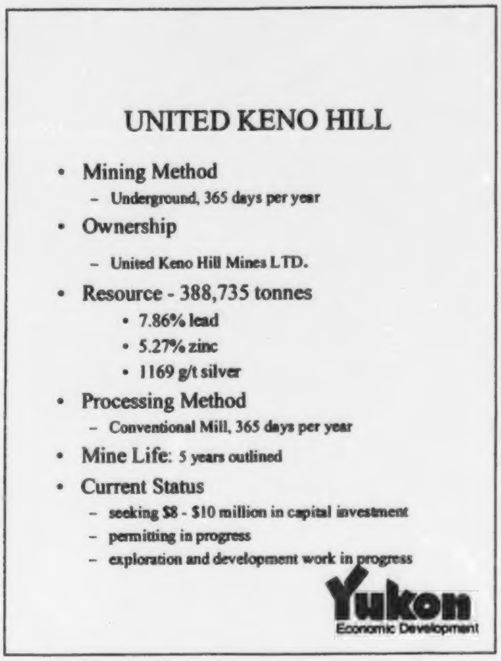
FYRE LAKE

- Mining method
  an open and underground mining operation
- Ownership
  - Columbia Gold Mines Ltd.
- Resource - 15.4 million tonnes of which 8.2 million grade (1% copper as cut off) :
  - 2.1 % copper
  - 0.11% cobalt
  - 0.73 g/t gold
- Current Status:
  - preliminary feasibility

Yukon
Economic Development

Fyre Lake

The Fyre Lake property is located approximately 30 km southwest of the Wolverine deposit. Mineralization consisting of Cu-Co-Au is hosted by schist derived from mafic volcanic flows interbedded with volcaniclastics and sedimentary rocks. Preliminary studies indicate a 15.4 million tonne resource within which 8.2 million tonnes grade 2.1% copper, 0.73 g/t gold and 0.11% cobalt using a 1% copper cut off.



UNITED KENO HILL

- Mining Method
  - Underground, 365 days per year
- Ownership
  - United Keno Hill Mines LTD.
- Resource - 388,735 tonnes
  - 7.86% lead
  - 5.27% zinc
  - 1169 g/t silver
- Processing Method
  - Conventional Mill, 365 days per year
- Mine Life: 5 years outlined
- Current Status
  - seeking $8 - $10 million in capital investment
  - permitting in progress
  - exploration and development work in progress

Yukon
Economic Development

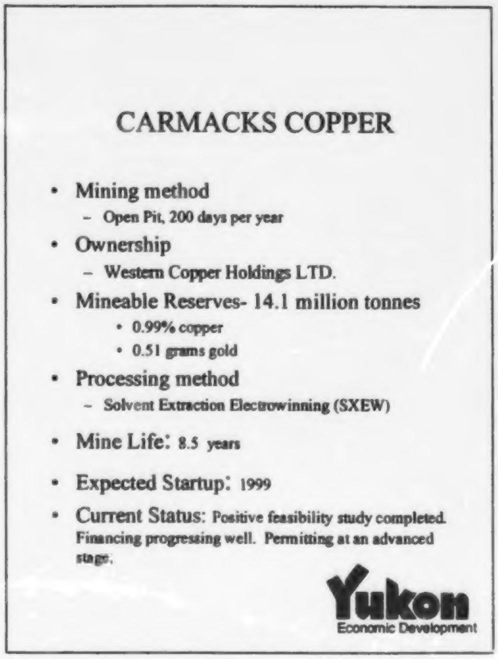
United Keno Hill Mines

United Keno Hill Mines is planning to place their silver property back into production. Located 350 km north of Whitehorse, this would be an underground mining and milling operation of the silver-lead-zinc veins at the rate of about 500 tonnes per day. Silver grades average 1169 grams per tonne.

Historical production from this area has been over 175 million ounces of silver, as well as lead and zinc. The current plans are to to produce 124 to 156 million grams of silver annually.

The company is applying for a license to begin production this year. They will require $8 to $10 million to bring the mine into production.

United Keno Hill Mines is a public company with headquarters in Toronto, Ontario, in Canada.



CARMACKS COPPER

- Mining method
  - Open Pit, 200 days per year
- Ownership
  - Western Copper Holdings LTD.
- Mineable Reserves- 14.1 million tonnes
  - 0.99% copper
  - 0.51 grams gold
- Processing method
  - Solvent Extraction Electrowinning (SXEW)
- Mine Life: 8.5 years
- Expected Startup: 1999
- Current Status: Positive feasibility study completed. Financing progressing well. Permitting at an advanced stage.

Yukon
Economic Development

Carmacks Copper

The copper and gold rich Carmacks Copper property is located 160 km north of Whitehorse, not far from the Minto deposit. There are mineable reserves of 14,109,800 tonnes grading 0.99% copper and 0.51 g/t gold. Mining would be by open pit methods with a heap leach operation to recover 80% to 85% of the copper by solvent extraction and electrowinning (SX-EW). The capital costs for this operation, with a daily production of 40.8 tonnes of copper for 8.5 years is $62 million.

There are numerous untested exploration targets on the property. The project is in the final stages of environmental permitting and of negotiation with local First Nations. The company has already planned for 10,000 tonnes of acid storage facilities at Skagway to accommodate ocean shipping schedule.

There is gold... and much more

- Tungsten
- Coal
- Placer gold
  - 13.4 million ounces of gold since 1898
- Barite, rhodonite, jade
- Prospecting for gemstones, sapphires, emeralds
  - one emerald discovery was announced in 1998.

Yukon
Economic Development

There are numerous other mining and exploration projects of importance in the Yukon. The Yukon Government produces a comprehensive summary of advanced properties in our "Mineral Property Update", available by ordering through our website or by calling the Department of Economic Development in Whitehorse. Summaries in Japanese on 18 of the properties are included I a report by the Metal Mining Agency of Japan. They can been seen in a recent column of current topics on the Metal Mining Agency of Japan Homepage (http://www.mmaj.go.jp). In addition to gold and base metals , other types of deposits are found in Yukon.

In the Dawson area, the historic Klondike gold fields produced $31.4 million worth of gold in1998. This region has produced at least 13 million ounces of gold since the turn of the century. Exploration is still ongoing in the search for a lode source of the placer deposits.

Last October, one large placer operation, in the Dawson area, Ross Mining in the Dawson area was honored by the visit of delegation of Japanese business men for Sumitomo Metal Mining Canada, Mitsubishi Material Corp., Dowa Mining Co., Sumito Canada, , the Metal Mining Agency of Japan and the Consul for Economic Affairs at the Consulate General of Japan in Vancouver. Mr. Nor m Ross gave a tour of his operation and gave the visitors a chance to handle placer gold and to watch it being poured into a gold brick.

Small barite, jade and rhodonite deposits are being mined. There have been two emerald discoveries in Yukon in the last three years.

Yukon Mining Investment for the 21st Century

For further information contact:

Jesse L. Duke
Mining Facilitator,
Department of Economic Development,
Government of Yukon
Box 2703,Whitehorse, Yukon
Canada Y1A 2C6

Phone: 867-667-3422
Fax: 876-667-8601
e - mail: jesse.duke@gov.yk.ca

Yukon
Economic Development

Jesse L. Duke
Mining Facilitator,
Department of Economic Development,
Government of Yukon
Box 2703, Whitehorse, Yukon
Canada Y1A 2C6

Phone: 867-667-3422
Fax: 876-667-8601
e - mail: jesse.duke@gov.yk.ca

TOKYO MINING INVESTMENT CONFERENCE

FEBRUARY 1999, TOKYO, JAPAN

CANADA: A WINDOW ON GLOBAL MINING
World-Class Technology and Investment Prospects

Ontario: A Canadian Leader in Mining Opportunities

By:
Dr. John Gammon,
Assistant Deputy Minister,
Mines and Minerals Division,
Ministry of Northern Development and Mines

SPEAKING NOTES

Dr. John Gammon

Assistant Deputy Minister,
Mines and Minerals Division,
Ministry of Northern Development and Mines
Government of Ontario

John Gammon was born and educated in England where he received his doctorate from the University of Durham. He moved to Canada in 1967 and was employed in the private sector with New Jersey Zinc followed by Falconbridge where he successively served as exploration manager in Scandinavia, South East Asia and Western North America.

Dr. Gammon joined the Ontario Ministry of Northern Development and Mines in 1988 as Director of Mineral Development and Lands Branch. He was appointed Assistant Deputy Minister, Mines and Minerals Division in 1990 and has been the principle advisor on mineral policy matters to three successive Ontario governments.

He has played a key role in developing major amendments to the Ontario Mining Act including the extensive revisions introduced in 1990, the introduction of mine site reclamation requirements and the move to a more self-regulatory role for the mining industry under the current government.

Dr. Gammon manages the Ministry's Mines and Minerals Division including the Ontario Geological Survey, the Mining Recorder system, mine site reclamation regulation, and the Resident Geologists' network.

He lives with his family in Sudbury under the shadow of mining headframes!

Ontario: A Canadian Leader in Mining Opportunities

It is my pleasure to be part of the Team Canada delegation and an honour to be in Tokyo representing Ontario.

Ontario is a major producer and explorer of a variety of mineral commodities, with excellent potential for the discovery of new world-class mines. In addition, we have a well-trained and skilled workforce and are the home base for many exploration and mining companies.

Today, I intend to offer you information – in words and slides – that will help you make an informed decision about Ontario – a decision that will let you explore the considerable opportunities that await you.

My presentation will consist of four parts.

First, an introduction to the province of Ontario.

Secondly, an overview of Ontario's mineral resources and industry.

Thirdly, a discussion of Ontario's position as a world centre for mining and our government's role in stimulating investment.

And finally, a quick and general overview of investment opportunities in Ontario's mineral industry.

Let's begin with the overview of Ontario.

Located in the heart of North America, Ontario is the most populous province in Canada, with a population of over 10 million people.

Ontario has an area of over one million square kilometers, and is the same size as France and Spain combined.

Ontario is Canada's economic engine. It generates about 40% of the Canadian Gross Domestic Product and produces over half of all Canadian manufactured goods and technology-intensive exports. Even when compared with G-7 nations, Ontario rates very well in terms of productivity growth, gross domestic product growth and exports per capita. If Ontario was a country in its own right, it would rank 13th in the world in industrial output.

We strongly encourage foreign investment and maintain a world class financing centre at the Toronto Stock Exchange which raises about 60% of the $10 billion annual equity financing for mining and exploration ventures worldwide.

This means that Ontario is home to one of the most balanced, diversified and productive economies in the world.

We all understand that prosperity is directly linked to trade.

Ontario's location, along with a modern transportation network makes it ideally suited for access not only to the lucrative North American markets but also those of the rest of the world.

The province has more than 150,000 kilometers of highways and municipal roads – enough roads to circle the globe more than three times. Well – established air, rail and shipping links carry our products to the four corners of the earth. Modern telecommunications systems allow us to exchange information instantaneously with our global partners.

The province of Ontario has a rich and colourful mining heritage dating back to the early 1800's.

Slide 1: Mining Activity (Historic Production)

Over the past century, Ontario has produced: 140 million ounces of gold, 1 billion ounces silver, 9 million tonnes of nickel, 12 million tonnes of copper and 8 million tonnes of zinc.

Ontario has a highly-developed mineral industry with a long history of production technological advances in both mining and mineral processing. The advances were the answers to challenges arising from the discovery and development of large, complex, high-grade ore bodies – such as the nickel-copper ores at Sudbury, the zinc-copper ores at the Timmins Kidd Creek mine and gold at Hemlo. (As an aside – the trans Canada highway passes alongside the 3 Hemlo mines, which account for 2% of the world's production.)

The existence of such ore bodies themselves are a testament to the very considerable geological endowment Ontario possesses. Ontario's geology is basically two stories, one for the northern part of the province, one for the southern part.

Most of northern Ontario is underlain by precambrian-aged rocks of the Canadian Shield. The exception is an area of younger sedimentary units that overly the Shield along the west coast of Hudson Bay.

Southern Ontario, occupying approximately 10% of the province in area, is underlain by sedimentary rocks of Paleozoic age, most of which are flat-lying. These fundamental differences in geology determine the distribution of mineral deposits in Ontario.

Generally, the Precambrian rocks of the Canadian Shield host deposits of base and precious metals.
The bedded sediments of southern Ontario host deposits of limestone, salt and gypsum and also host to natural gas and oil. North America's first producing oil well was located in southern Ontario.

Ontario's geology is famous around the world for the number of discoveries it has yielded. In the last 50 years, over 70 significant base metal and precious metal deposits have been discovered.

Slide 2: Mining Activity – Mines 1998

Ontario has 20 base metal, 17 gold, 3 platinum group metals, 19 industrial mineral and 2 iron mines currently operating in the province. In addition, there are 60 dimensional stone quarries producing a wide variety of products.

This kind of activity means that mining has a very significant economic impact on the entire province and, most particularly, northern Ontario. In 1997, there were 75,000 people employed directly in the mining and metals industries.

Slide 3: Mining Activity – Slide of Top 10 Commodities

The top 10 commodities produced by value in Ontario are nickel, gold, copper, cement, sand & gravel, stone, salt, zinc, cobalt and platinum group metals. In total, more than 30 mineral commodities are produced, including iron ore, silver, magnesium, gypsum, sulphur and some less familiar commodities such as tellurium, selenium and indium.

Slide 4: Ontario Mining Activity - Commodity and World Ranking

In terms of worldwide production, Ontario would rank 2nd in nickel and cobalt, 3rd in platinum group metals, 8th in gold, 12th in copper, 14th in silver and 15th in zinc.

Slide 5: Annual Value of Mineral Production, 1997

Mineral production has exceeded $4 billion annually for a number of years. Most of the value comes from metallics such as gold, nickel, copper, and zinc.

Slide 6: Mining Activity – 1997 Mineral Production
Slide 7: Percentage of Canadian Mineral Production by Province, 1997

In 1997, Ontario production reached $5.5 billion, accounting for approximately 34% of Canada's metal production.

In mining, as you well know, there is no tomorrow without exploration and, it is a year round activity in Ontario.

Slide 8: Mineral Exploration Expenditures

Mineral exploration expenditures in Ontario totaled $174 million in 1997. Exploration expenditures in 1998 and 1999 are forecast to be slightly less than the previous year as a result of a general decline in commodity prices.

Investment in mineral exploration eventually leads to further capital investments in new mine developments such as the Musselwhite project in northwestern Ontario, and the new $100 million Agrium phosphate development near Kapuskasing.

Slide 9: Exploration and Development Expenditures

In all, mineral exploration and mine development expenditures in Ontario totaled over $434 million in 1997. Most of the activity involved gold, base metal and diamond exploration in northern Ontario.

The government of Ontario welcomes the exploration and the development of mineral deposits.

This brings me to a source of great pride for my colleagues and I in Ontario – the stewardship of mineral resources as embodied in our land access and environmental policies.

Ontario's Mining Act

After extensive consultation with the mining industry, statutes affecting exploration, development and mining were revised in 1991 and a new Mining Act was proclaimed in June of that year.

Significant improvements from the old mining act were made in the areas of security of land tenure, the land acquisition process, permitting procedures and work requirements to maintain mineral rights.

Provisions of the new Mining Act and the regulations cover all stages of mining activity including advanced exploration, development and closure. Some of the significant changes reflect a commitment by the government and the industry to environmental concerns of the people in Canada and around the world.

The Ontario Geological Survey (OGS), is world renowned for the quality of work done by the Precambrian and Sedimentary Geoscience Mapping Sections and an extensive network of 10 resident geologist offices located throughout the province. These Sections provide vital information and expertise to the mining, exploration and mineral development industry. The OGS generates high quality maps and reports on Ontario's geological resources that are readily available to the minerals industry and the general public.

Ontario continues its commitment to client service with the development of several computerized databases. One in particular – the Earth Resources and Land Information System (ERLIS) – was a $26 million dollar, multi-disciplinary initiative within our Ministry which developed computerized data sets of information including assessment files, all Ontario Geological Survey publications and digital geological maps.

It contains 1.5 million pages of documents, 100,000 maps, 120,000 claim reports, 37,000 exploration assessment reports, 15,000 rock analyses, 12,000 diamond drill logs, 13,000 mineral occurrences and 4,000 geological reports. ERLIS gives mineral explorationists and developers electronic access to our various databases containing the full spectrum of geological, geochemical and geophysical data for Ontario.

Work is currently underway to provide access to this vast array of data via the internet and will be implemented by mid 1999.

In addition, our ministry has created a comprehensive mining lands information system which offer fast and easy access to land tenure information on the internet.

Up to date claim maps are also now available on our web site @ **www.gov.on.ca/mndm/mines/lands**. This enables our clients to do business 7 days a week, 24 hours a day.

That brings me to the final part of my presentation. I would like to briefly discuss with you the mineral investment opportunities available in Ontario.

The Ontario Geological Survey generates high quality maps and reports on Ontario's minerals resources and makes this information available to the minerals industry. Each year, the Ministry reports on the survey's findings and makes recommendations for exploration targets.

On a more local scale, each of our field offices throughout the province also make available their recommendations for exploration for their respective areas.

You can find those recommendations as well as substantial amounts of other information of interest posted on our internet web site **www.gov.on.ca/mndm**.

In addition, the Ministry of Northern Development and Mines compiles a comprehensive list of properties with mineral inventories not currently being mined. There are about 175 such properties. This list is also accessible though our web site.

Slide 9: Investment Opportunities

The primary commodities on this list are gold, (estimated 17 million ounces of contained gold) nickel, copper, and zinc. Other commodities include platinum metals, graphite, phosphates, rare elements and rare earth elements.

Slide 10: Lac des Iles Monthly Palladium Production

A recent increase of over $100 per ounce in the price of palladium has greatly improved profitability at North American Palladium Ltd's mine, north of Thunder Bay. The operation is an open pit mine that has been producing at a rate of 3000 tpd since commercial production began in 1994. Production statistics for 1998, indicate that compared with the previous year, palladium production increased by almost 100%.

Slide 11: 1997 Industrial Mineral Production

Ontario is also a major producer of industrial minerals with a total production of $1.6 billion; including non metallic production of $140 million and structural mineral production of $1.25 billion.

Recently, diamond discoveries have heightened excitement in Ontario. Most of the activity has focused in the Kirkland Lake, cobalt and James Bay Lowland areas. Although kimberlite was first identified in Ontario by a provincial government geologist in 1945, exploration for diamonds did not begin in earnest until very recently.

I am pleased to add that the discovery of these kimberlite pipes, was spurred by geophysical data gathered by our Ministry and prospecting activities funded by a grant from the Ministry's Ontario Prospectors Assistance Program.

Judging by the quantity and quality of diamonds that have been recovered from bulk samples to date, we are confident that Ontario will join the ranks of diamond producers in the future.

Agrium's phosphate project in a carbonatite complex in northeastern Ontario is expected to go into production this year with an annual production rate of 1 million tonnes of concentrate.

In 1997, an OGS geologist discovered a substantial deposit of rare elements – lithium, tantalum, rubidium and cesium – in pegmatites located in northwestern Ontario. The announcement was made in a public news release and the area was claimed under Ontario's open claim staking system.

This deposit contains high grade petalite suitable for the glass and ceramics industry and has a potential value of over $1 billion. It represents a new deposit type for Ontario and illustrates that there probably a number of undiscovered new commodity types in Ontario's vast land base.

Marble and granite dimension stone quarries occur across Ontario and are the target of a number of exploration and development projects.

A host of other unusual industrial minerals under production and development in Ontario include: clay minerals, vermiculite, high-purity silica, garnet, kyanite, wollastonite, and large flake graphite.

Slide 12: Fraser Institute Graph

To conclude, a recent survey of mining company operations in North America, conducted by the Fraser Institute, found Ontario to be the best jurisdiction in Canada and second best in North America for exploration and mine development, due to its mineral potential and policies that support the mining industry.

I hope that this overview has provided you with some insights into the opportunities available in Ontario and the services we offer to the minerals industry to assist them in the search for Ontario's next major discovery.

On behalf of the Honourable Chris Hodgson, Ontario's Minister of Northern Development and Mines, I invite you to explore the opportunities in Ontario, Canada.

If you want to explore for new or traditional commodities, our geology and support services make Ontario the obvious first choice.

If you are considering a manufacturing centre close to raw material supply and central to the most affluent market in the world – Ontario is the obvious first choice.

If you have an interest in mined commodities for trade, investment or production, then Toronto is clearly where you need to be.

It has been my pleasure to be with you today. I encourage you to pick up information and pamphlets on Ontario before you leave if you have not already done so.

Hope to see you in Ontario.

ONTARIO
CANADA

Mining Activity

Over the past century, Ontario has produced:

- 140 million ounces of gold
- 1 billion ounces of silver
- 9 million tonnes of nickel
- 12 million tonnes of copper
- 8 million tonnes of zinc

Source: Ontario Ministry of Northern Development and Mines

ONTARIO
CANADA

Ontario Mining Activity

Ontario Mines in 1998,

- 20 base metal (nickel, copper, zinc)
- 17 gold
- 3 platinum group metals
- 19 industrial minerals
- 2 iron

Source: Ontario Ministry of Northern Development and Mines

ONTARIO
CANADA

Ontario Mining Activity

The top 10 commodities produced (by value) in 1998,

1. Nickel
2. Gold
3. Copper
4. Cement
5. Sand and Gravel
6. Stone
7. Salt
8. Zinc
9. Platinum
10. Cobalt

Source: Ontario Ministry of Northern Development and Mines

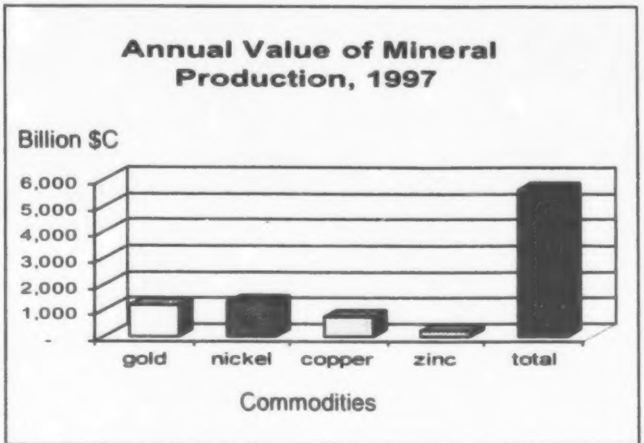
ONTARIO
CANADA

Ontario Mining Activity

Commodity	World Ranking
Nickel	2nd
Cobalt	2nd
Platinum	3rd
Gold	8th
Copper	12th
Silver	14th
Zinc	15th

Source: Ontario Ministry of Northern Development and Mines

ONTARIO
CANADA



ONTARIO
CANADA

Ontario Mining Activity

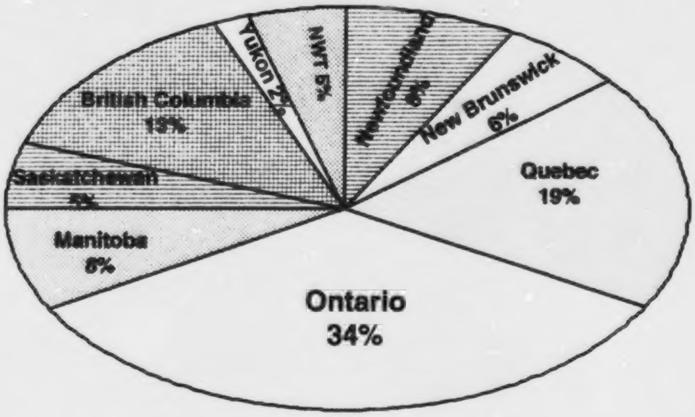
Of the 5.5 billion in mineral production in 1997,

- $3.8 billion (70%) was from metallic mining
- $1.2 billion (22%) was from structural materials
- $374 million (7%) was from non-metals mining

Source: Ontario Ministry of Northern Development and Mines

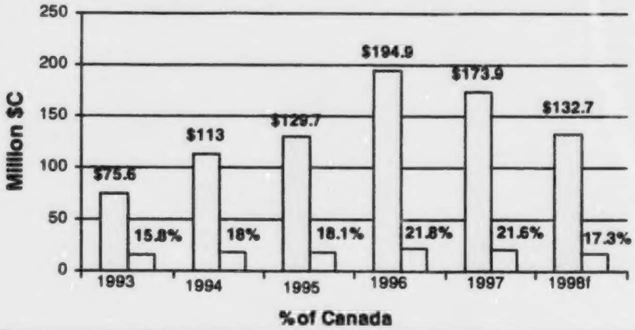
ONTARIO
CANADA

% of Canadian Mineral Production by Province, 1997



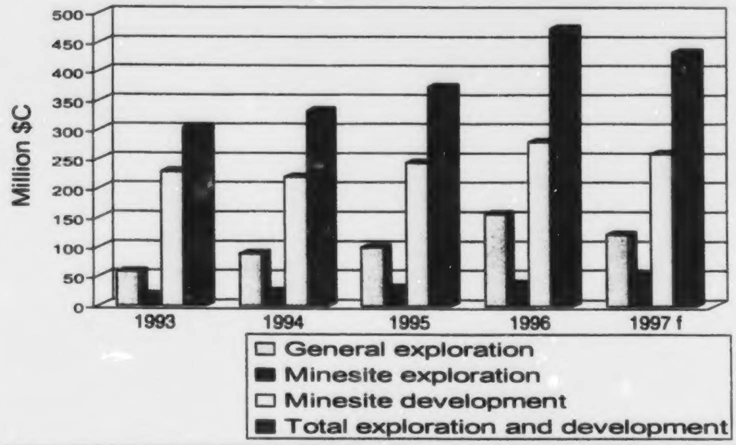
ONTARIO
CANADA

Ontario Mineral Exploration Expenditures



ONTARIO
CANADA

Exploration and Development Expenditures



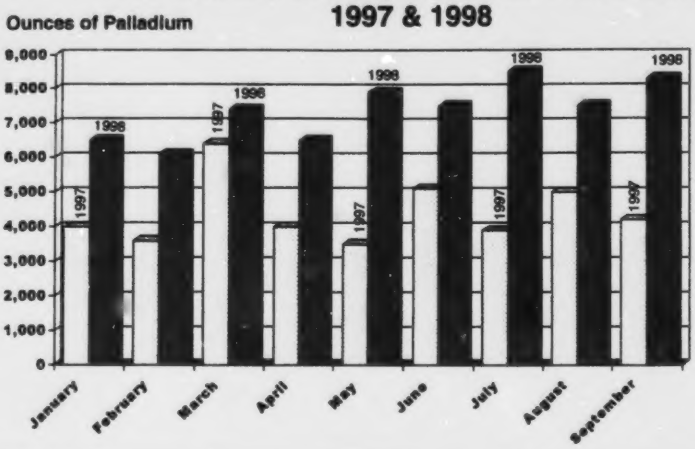
ONTARIO
CANADA

Investment Opportunities
List of Commodities

Cadmium, Calcium, Cobalt, Copper, Gold, Indium, Iron Ore, Magnesium, Nickel, Platinum Group, Selenium, Silver, Tellurium, Uranium, Zinc, Barite, Gemstone, Gypsum, Nepheline syenite, Quartz, Salt, Serpentine, Soapstone, Talc, Sulphur, Tremolite, Natural Gas, Crude Oil, Clay Products, Cement, Lime,Sand & Gravel, Stone

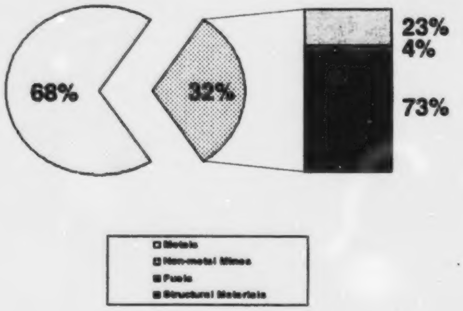
ONTARIO
CANADA

Lac Des Iles Monthly Palladium Production 1997 & 1998



ONTARIO
CANADA

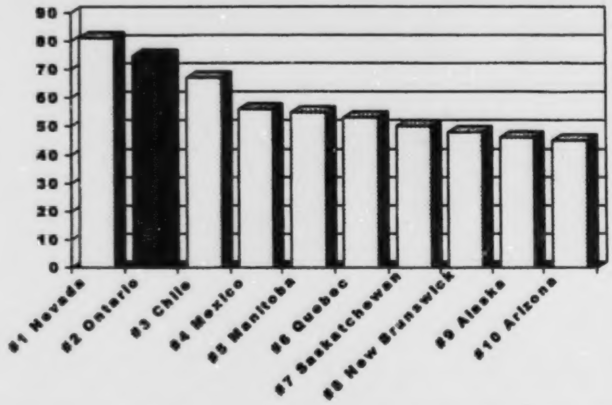
Industrial Mineral Production, 1997



ONTARIO
CANADA

1998 FRASER INSTITUTE REPORT

Investment Attractiveness Index (North America & Chile)



British Columbia:
Strategic Advantages for Mining Investment

Extract of Presentation

The Honourable Dan Miller
Minister of Energy and Mines
Government of British Columbia

CANADA: A WINDOW ON GLOBAL MINING
World-Class Technology and Investment Prospects
Canadian Embassy, Tokyo, Japan
February 16, 1999

Honourable Arthur Daniel Miller (North Coast)

Deputy Premier and Minister of Energy and Mines
Government of British Columbia
MLA - North Coast, (New Democratic Party)

Dan Miller was born in Port Alice, British Columbia on December 24, 1944. He was educated in North Vancouver and then moved to northern British Columbia where he settled in Prince Rupert, B.C. He began his political career as a Municipal Councillor in the City of Prince Rupert and was a Member of the Board of the Skeena-Queen Charlotte Regional District.

Mr. Miller was first elected to represent the Prince Rupert area (North Coast) in the British Columbia Legislature in 1986. He was re-elected in both 1991 and 1996. He has served as Minister of Forests, Minister of Skills Training and Labour Minister of Municipal Affairs and Minister of Employment and Investment. On June 17, 1996 he was appointed Deputy Premier in addition to his Cabinet portfolio. He was re-appointed September 23, 1996 and January 6, 1997 when he became Minister of Energy and Mines.

Mr. Miller is married to Gayle and has five children.

British Columbia: Strategic Advantages for Mining Investment

Good Afternoon

I am pleased to have the opportunity to speak to you today at this Mining Investment Seminar. I also appreciate the opportunity to meet and talk to Japanese companies to understand their issues.

I would like to thank the Canadian Embassy for providing the opportunity for me to outline some of the important changes that my government has instituted to make British Columbia a more attractive place for mining investment.

As you may be aware, British Columbia has some of the best geology in the world for both minerals and coal.

As well, our mining companies are proven world leaders in their ability to extract minerals from lower grade ores and be competitive in today's global market place.

More than any other Canadian province, British Columbia is closely linked to Japan and the Asia-Pacific economies.

Japan is our most valuable mineral customer: 67% of our copper, 97% of our precious metals, 60% of our molybdenum and 70% of our coal were shipped to Japan in 1997.

And investment by Japanese companies has played a significant role in new mine developments in B.C., such as the Mt. Polley copper/gold project and the Huckleberry copper/gold project.

But we have recognized that we must do more. As Chairman Miyama noted this morning, Japanese companies have taken steps to reduce costs. If B.C. wants to continue to attract investment and continue to produce minerals for export at competitive prices, we have to make changes - and we have.

In the short term, to assist companies in the face of declining mineral prices, we have offered significant reductions in energy costs.

As a result of our actions, we have now completed agreements that have allowed a number of mining companies to continue to operate. These agreement, with Mt. Polly, Huckleberry and Thompson Creek's Endako molybdenum mine, have provided more security for Japanese investments and stability for employees and communities.

But these are short term. For the longer term, we have made fundamental changes.

Last year we announced our new **Mining Initiative**.

1. New legislation was passed last year - The Mining Rights Amendment Act.

   This Act recognizes the right to mine and states that we value the mining industry in our province. It provides assurance of access to mineral tenures for claim holders. It guarantees compensation when tenures are expropriated for park purposes. And it requires timely permitting for mining projects.

2. We have also developed a new Mineral Exploration Code, specifically for the mining industry.

   This Code is more streamlined, less bureaucratic, and all permitting is through one agency, my Ministry.

3. We have instituted a Mining Exploration Tax Credit, which refunds 20% of eligible exploration expenses by prospectors and mining companies.

4. And we have executed the New Mine Capital Allowance to the year 2008.

5. To assist in our new approach, we have created a new position in the Ministry, the Mining Advocate.

   This position has been filled by a person from the private sector with a background in the mining industry. His job is to assist companies in all aspects related to mining and to promote a positive investment climate.

These positive changes, coupled with our Power for Jobs initiative, should create a better mining investment climate in British Columbia.

Under our Power for Jobs program, surplus energy is made available for new projects at rates as low as 2 cent per Kwh.

Finally, the Nisga'a Treaty, the first modern day treaty between the governments of Canada and British Columbia and the Nisga'a First Nation, proves we can conclude an agreement that provides certainty. My new Deputy Minister, Mr. Jack Ebbels, was our chief negotiator. And he will be staying over an extra night, if you wish to speak with him.

In conclusion, while we all recognize the current problems in the global market place, particularly commodity prices, there will be a continuing demand for minerals, and British Columbia welcomes the opportunity to play a significant role.

Nunavut: A New Territory to Explore

Mr. Gordon MacKay
Director (Designate)
Minerals, Oil and Gas Division
Government of Nunavut

CANADA: A WINDOW ON GLOBAL MINING
World-Class Technology and Investment Prospects
Canadian Embassy, Tokyo, Japan
February 16, 1999

Nunavut: A New Territory to Explore

Forty-two days from today, on April 1st, 1999 the creation of Nunavut will mark a historic step in the evolution of the Canadian frontier. The map of Canada will be changed for the first time in 51 years.

The creation of the Territory of Nunavut is an integral, but separate part of the Nunavut Land Claim Agreement which officially brought the Inuit people of Nunavut into the Canadian Federation. Nunavut will be the only jurisdiction in Canada, and one of very few around the world to have a modern comprehensive land claim agreement negotiated between equals.

At almost 2 million square kilometers, Nunavut is the largest and least explored region of Canada, representing 23% of Canada's landmass.

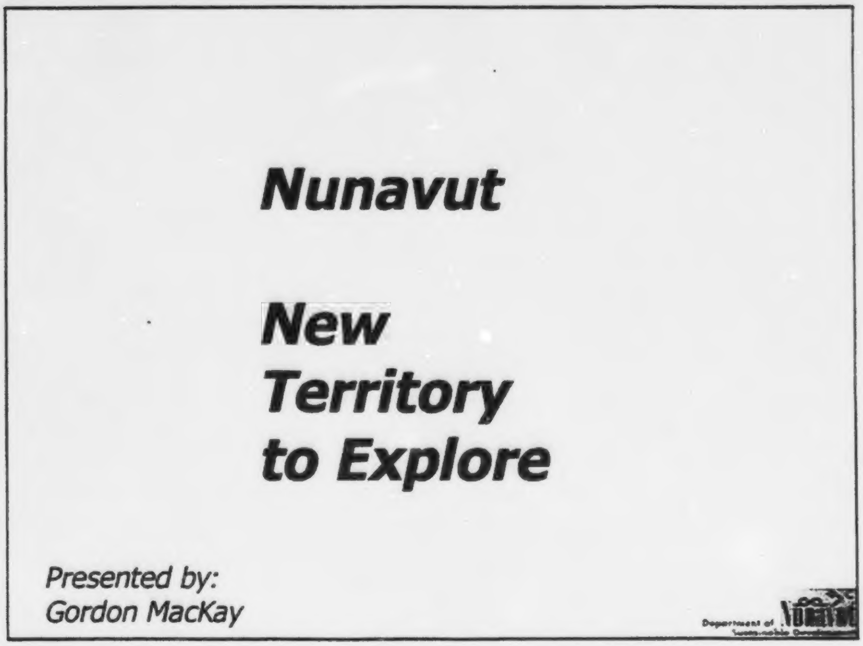
The governance of the Territory will be a partnership between Nunavut Tunngavik Incorporated, representing the Inuit, the Nunavut Government, representing all the people of Nunavut, and the Federal Government, representing the people of Canada. While that sounds complicated in reality it is much simpler. Each organization has distinct areas of responsibility, and where that responsibility overlaps strong cooperative partnerships have been developed.

With the creation of Nunavut the legislation and regulation of mineral exploration and mining will not change. The new government will be committed to working with Nunavut Tunngavik Incorporated and the Federal Government to ensure that any future changes will streamline and simplify the present system.

At present there are two operating mines in Nunavut, Polaris (Cominco), and Nanasivik (Breakwater Resources). Both mines produce zinc as their major product.

Arctic conditions provide opportunities for innovative engineering solutions to common mining challenges such as ground support, tailings disposal, and water dams and diversions.

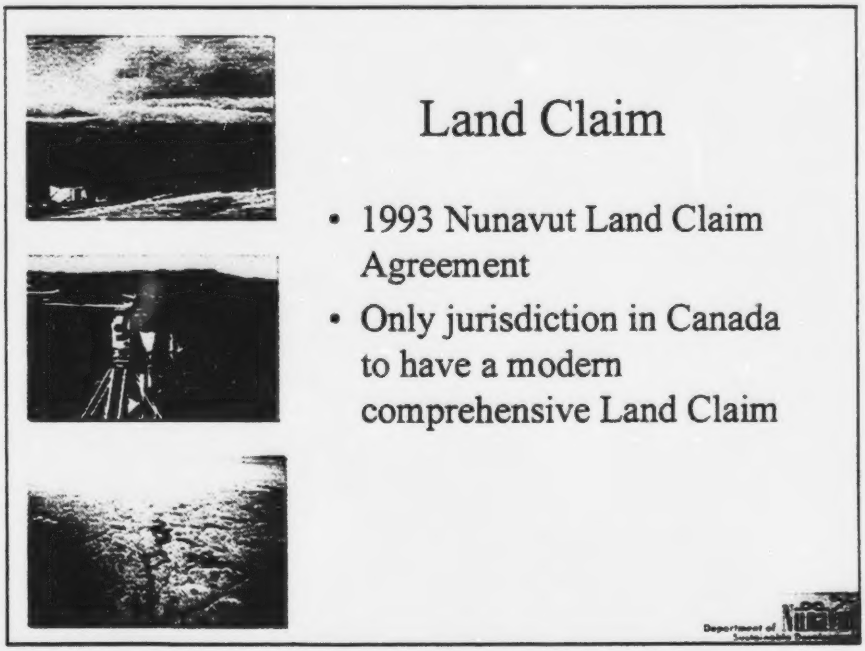
While many jurisdictions are experiencing a down turn in mineral exploration activity in Nunavut, the discovery of diamonds, the infrastructure provided by abundant access to tide water, and major new gold discoveries has resulted in Nunavut experiencing an increase in exploration activity.



Nunavut

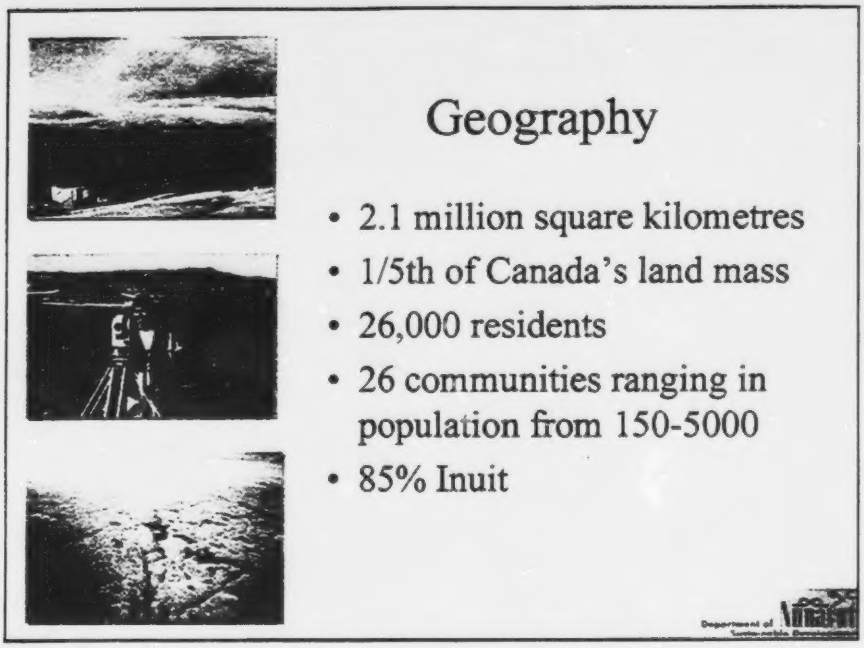
New Territory to Explore

Presented by:
Gordon MacKay



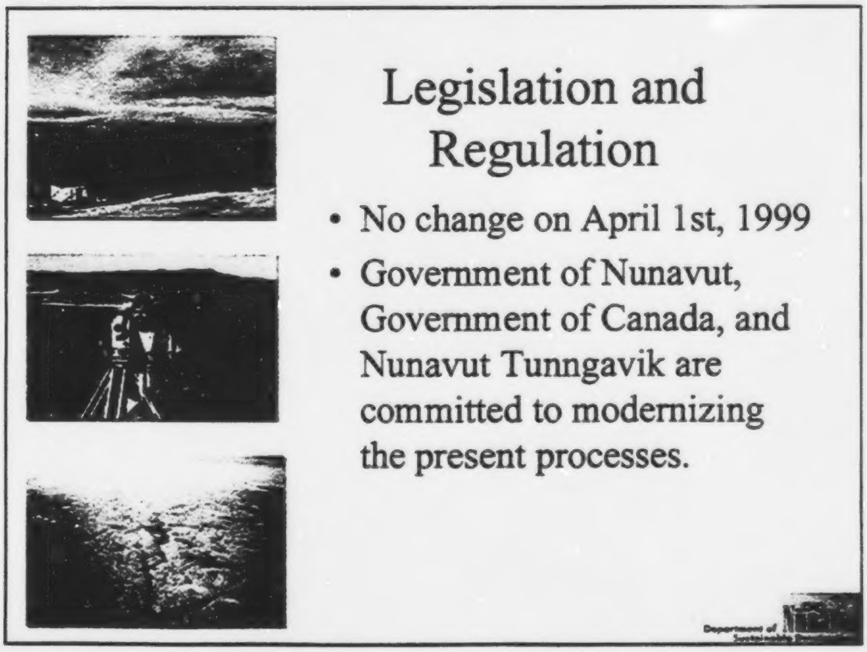
Land Claim

- 1993 Nunavut Land Claim Agreement
- Only jurisdiction in Canada to have a modern comprehensive Land Claim



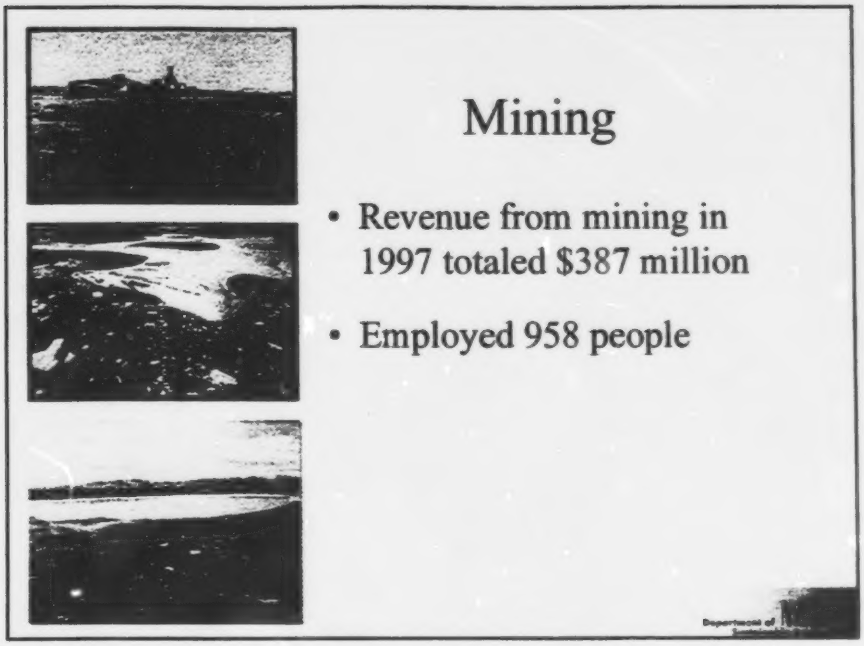
Geography

- 2.1 million square kilometres
- 1/5th of Canada's land mass
- 26,000 residents
- 26 communities ranging in population from 150-5000
- 85% Inuit



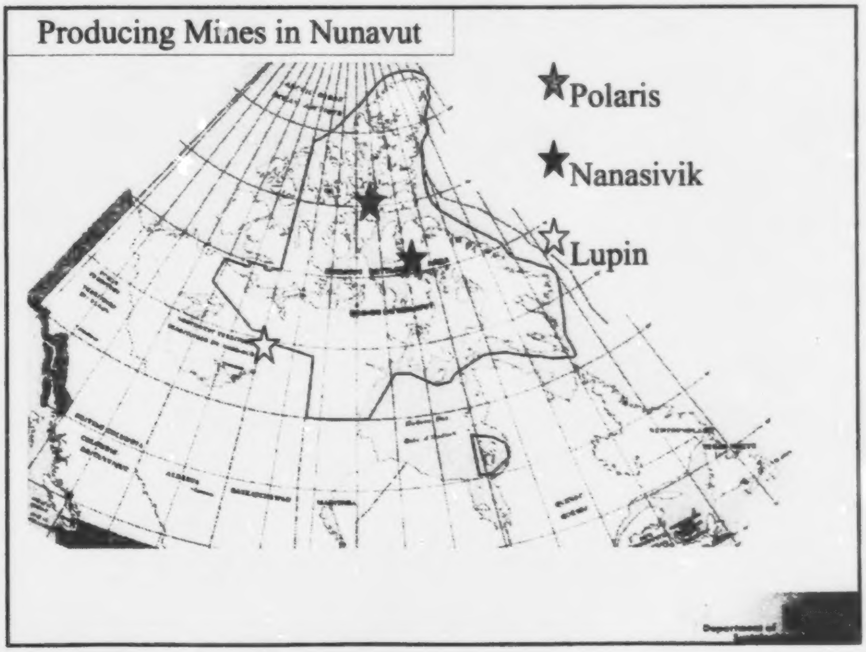
Legislation and Regulation

- No change on April 1st, 1999
- Government of Nunavut, Government of Canada, and Nunavut Tunngavik are committed to modernizing the present processes.



Mining

- Revenue from mining in 1997 totaled $387 million
- Employed 958 people



Producing Mines in Nunavut

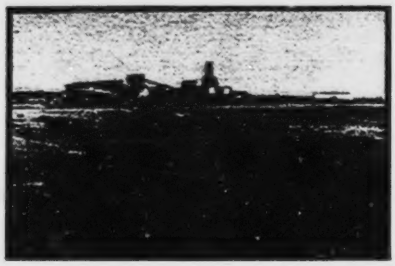
★ Polaris

★ Nanasivik

☆ Lupin

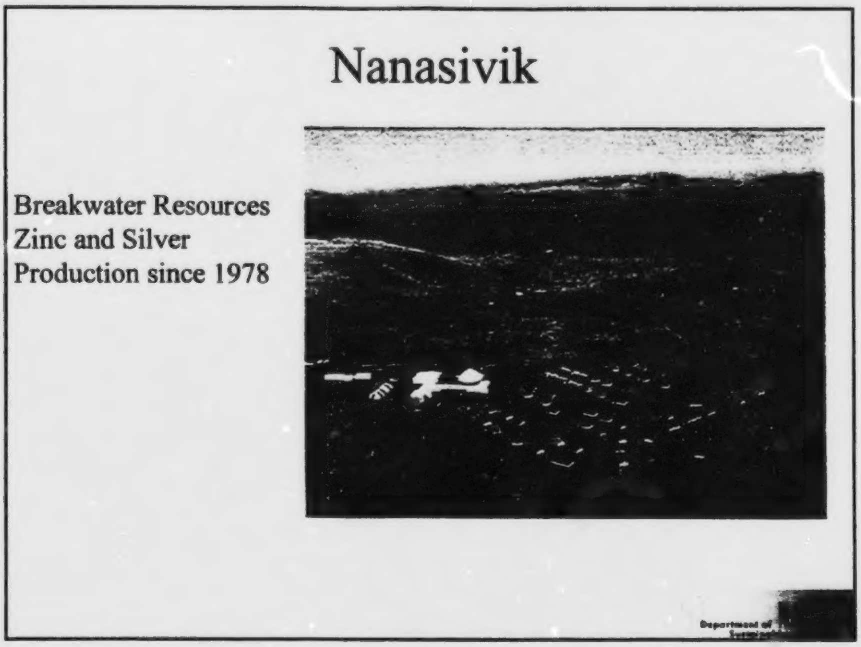
Lupin

- **Echo Bay Ltd.**
- **Gold and Silver**
- **Production since 1982**
- **Placed on care and maintenance in January 1998 due to low gold prices**



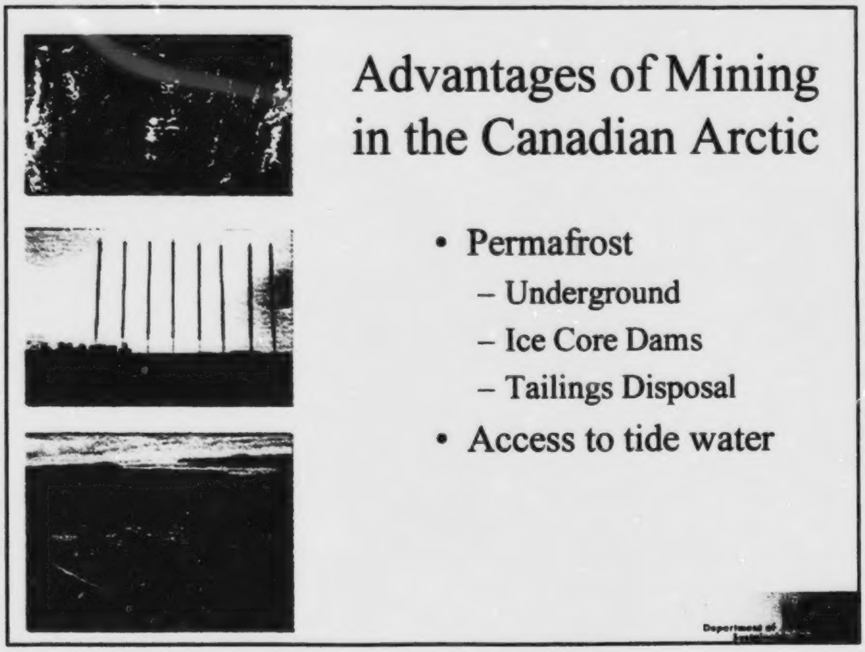
Polaris

- **Cominco Ltd.**
- **Zinc and Lead**
- **Production since 1982**
- **Northern-most base metal mine in the world**



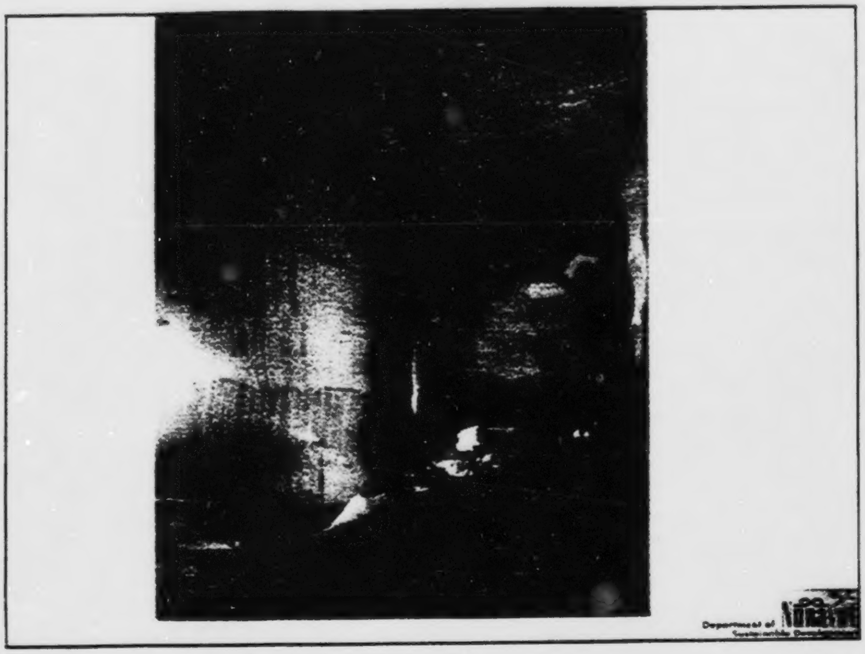
Nanasivik

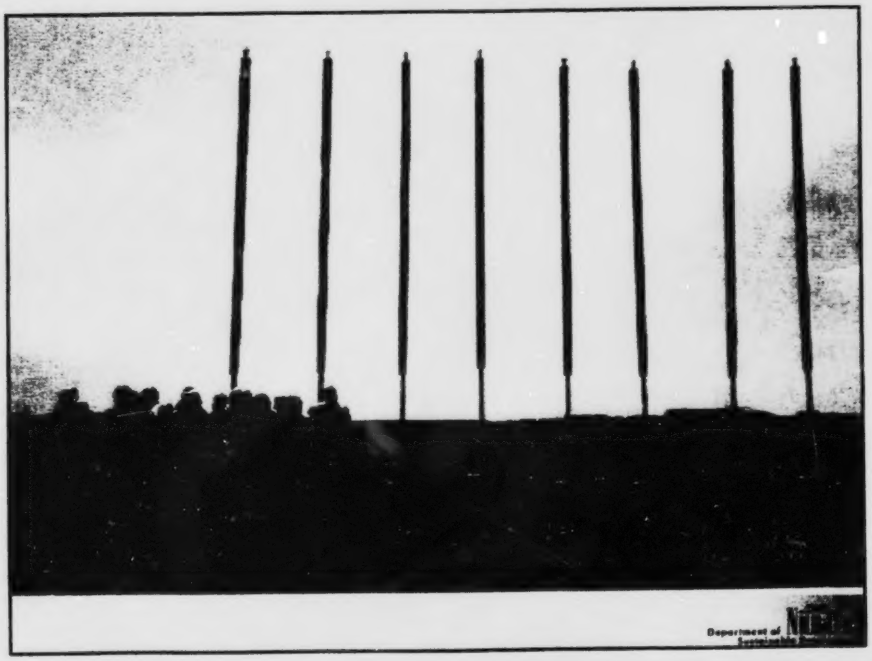
Breakwater Resources
Zinc and Silver
Production since 1978



Advantages of Mining in the Canadian Arctic

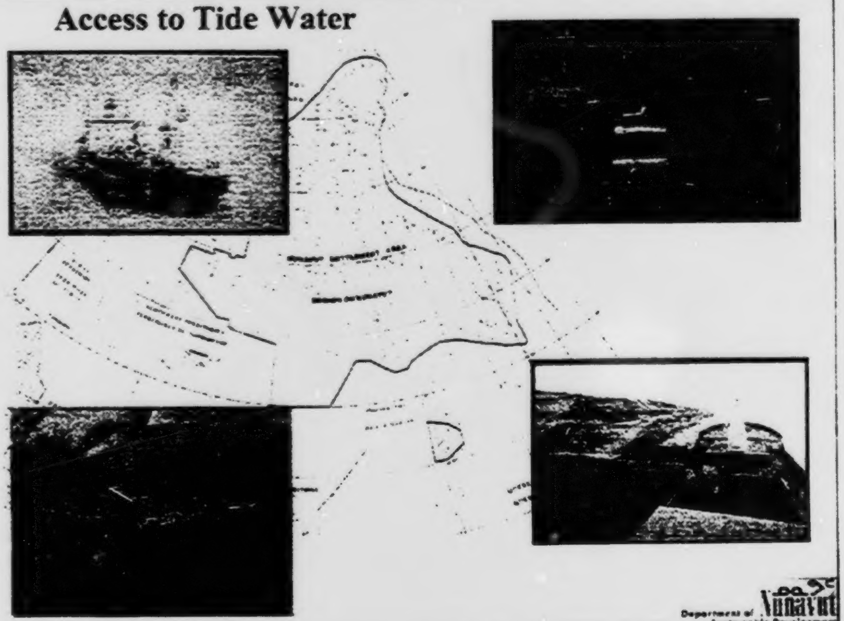
- Permafrost
  - Underground
  - Ice Core Dams
  - Tailings Disposal
- Access to tide water


Department of
Sustainable


Department of
Sustainable

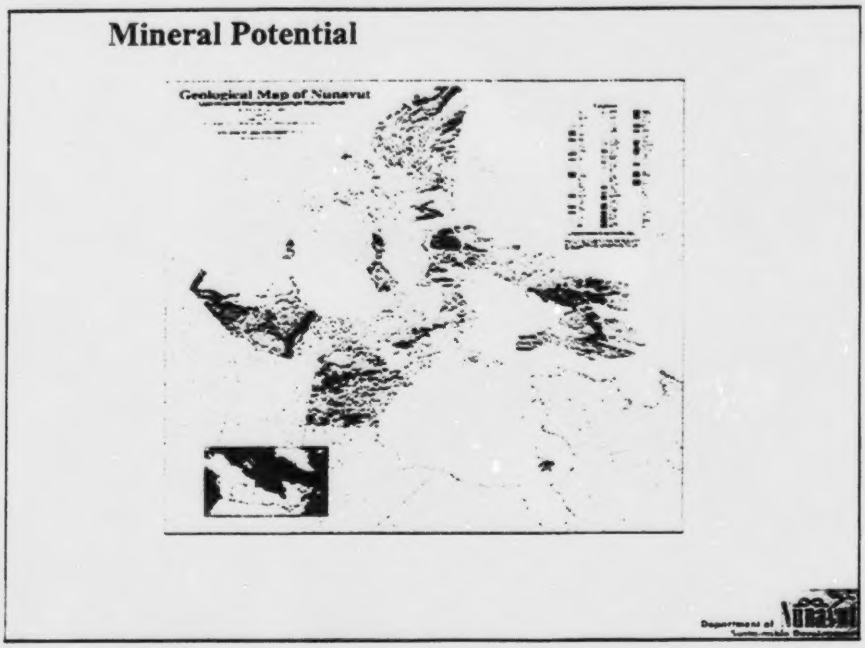
Department of Sustainable Development Nunavut

Access to Tide Water

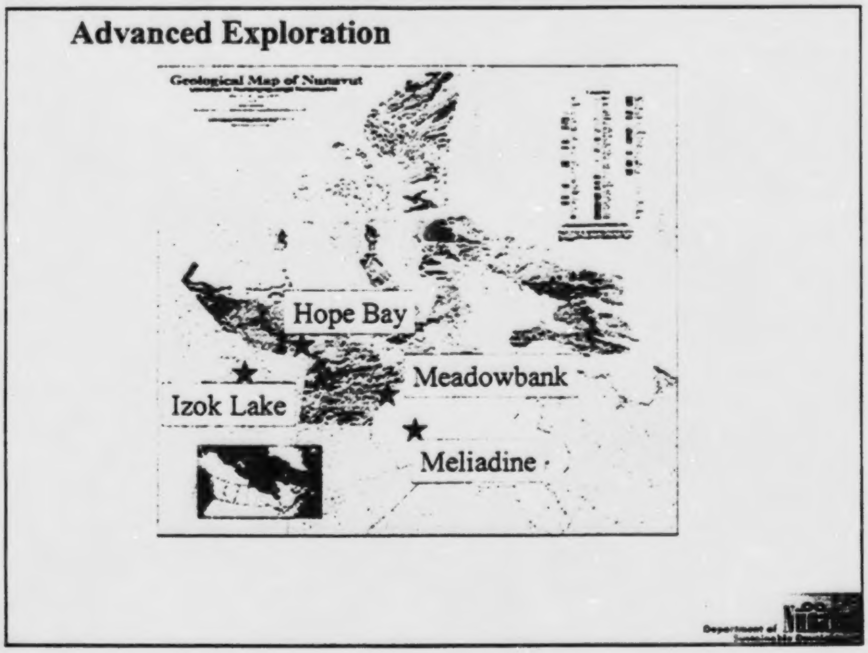


Department of Sustainable Development Nunavut

Mineral Potential


Geological Map of Nunavut
Department of
Nunavut
Sustainable Development

Advanced Exploration

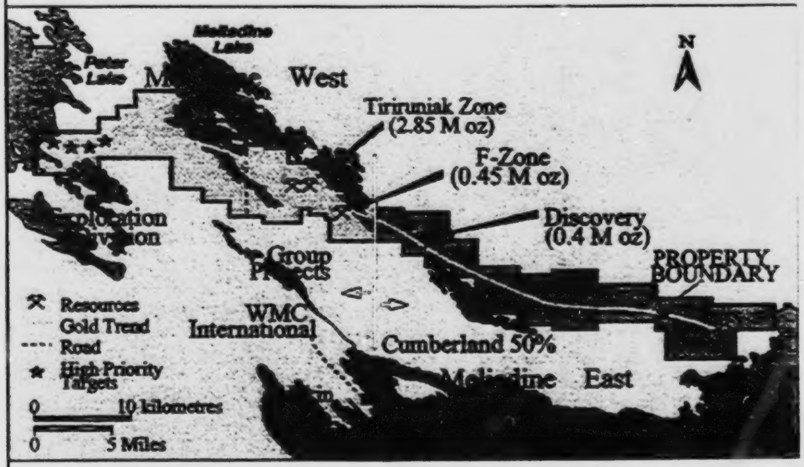

Geological Map of Nunavut
Hope Bay
Meadowbank
Izok Lake
Meliadine
Department of
Nunavut
Sustainable Development

Meliadine West

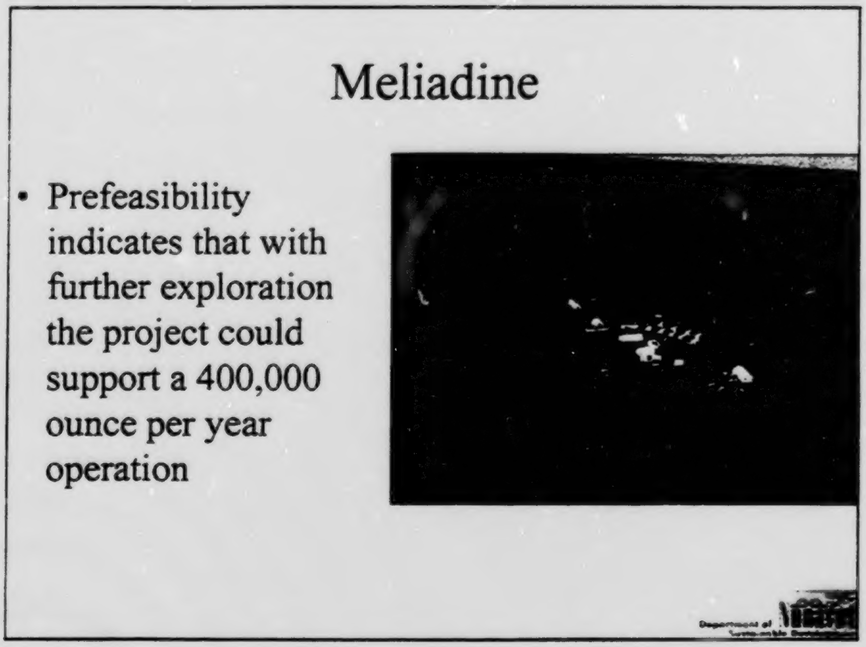
- WMC International with partners Cumberland Resources and Comaplex Resources
- 1997 resources at 3.3 M oz
- Preliminary metallurgy
  - 96% to 98% total recovery
- Over $31 million spent since 1995

Department of Sustainable Development Nunavut

Meliadine

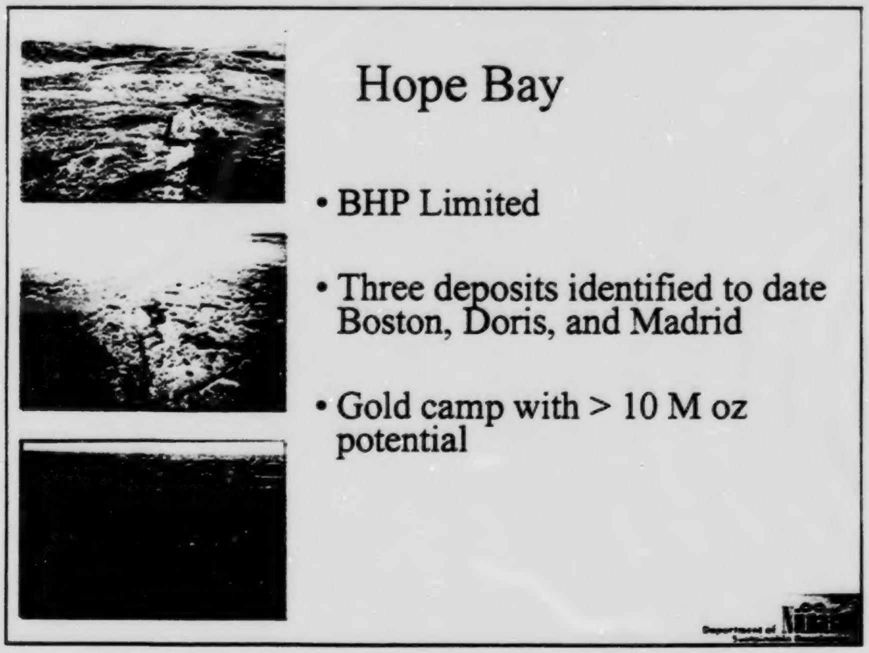

Meliadine Lake
Peter Lake
Meliadine West
N
Tiriruniak Zone (2.85 M oz)
F-Zone (0.45 M oz)
Discovery (0.4 M oz)
PROPERTY BOUNDARY
Exploration Division
Group Projects
WMC International
Cumberland 50%
Meliadine East
Resources
Gold Trend
Road
High Priority Targets
0 10 kilometres
0 5 Miles

Department of Sustainable Development Nunavut



Meliadine

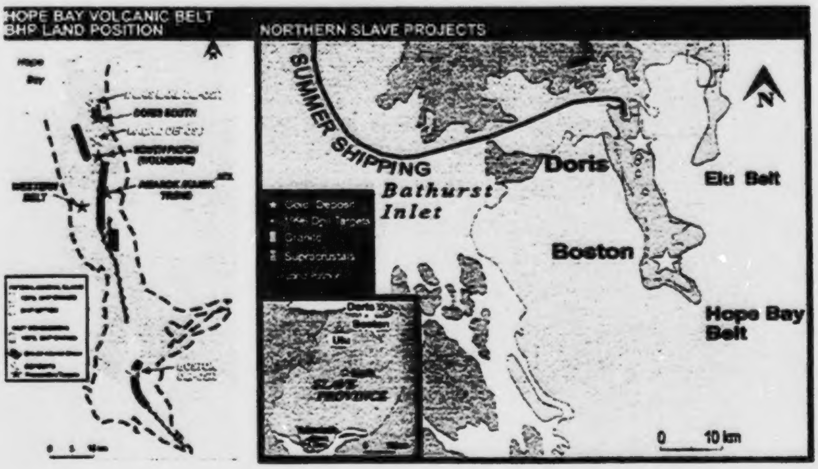
- Prefeasibility indicates that with further exploration the project could support a 400,000 ounce per year operation



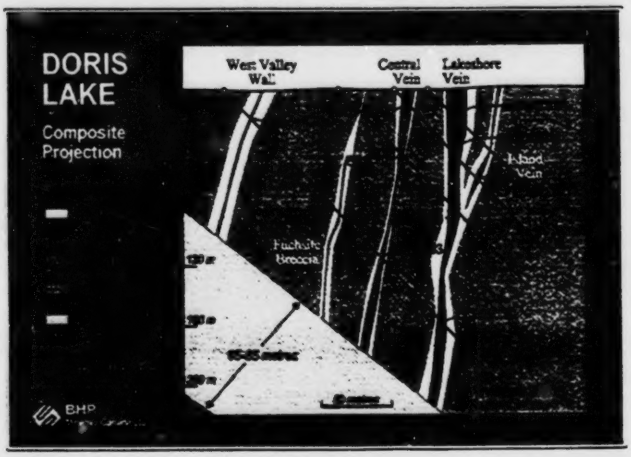
Hope Bay

- BHP Limited
- Three deposits identified to date Boston, Doris, and Madrid
- Gold camp with > 10 M oz potential

Hope Bay Belt


HOPE BAY VOLCANIC BELT
BHP LAND POSITION
Hope Bay
DORIS SOUTH
WESTERN BELT
0 5 10km
NORTHERN SLAVE PROJECTS
N
SUMMER SHIPPING
Bathurst Inlet
Doris
Elu Belt
Boston
Hope Bay Belt
Gold Deposit
Granitic
Supracrustals
Doris
Boston
Ulu
SLAVE PROVINCE
0 10 km

DORIS LAKE X-SECTION

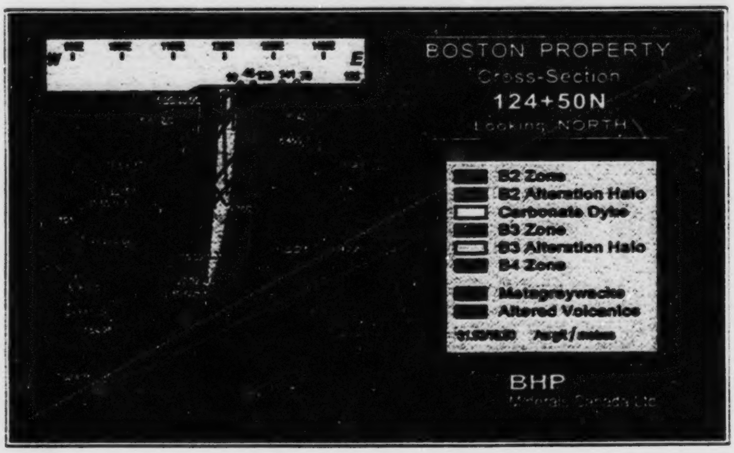

DORIS LAKE
Composite Projection
West Valley Wall
Central Vein
Lakeshore Vein
Island Vein
Fuchsite Breccia
BHP

DORIS GOLD

Gold is closely associated with Tourmaline, Py, Paragonite, and Chlorite partings in quartz veins

Department of
Sustainable Development

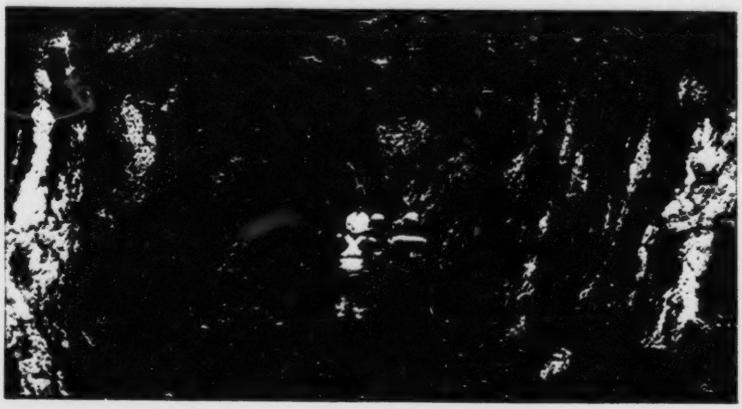
BOSTON X-SECTION


W
E
BOSTON PROPERTY
Cross-Section
124+50N
Looking NORTH
▬ B2 Zone
▬ B2 Alteration Halo
☐ Carbonate Dyke
▬ B3 Zone
☐ B3 Alteration Halo
▬ B4 Zone
▬ Metagreywacke
▬ Altered Volcanics
Au g/t / metres
BHP
Minerals Canada Ltd

Department of
Sustainable Development

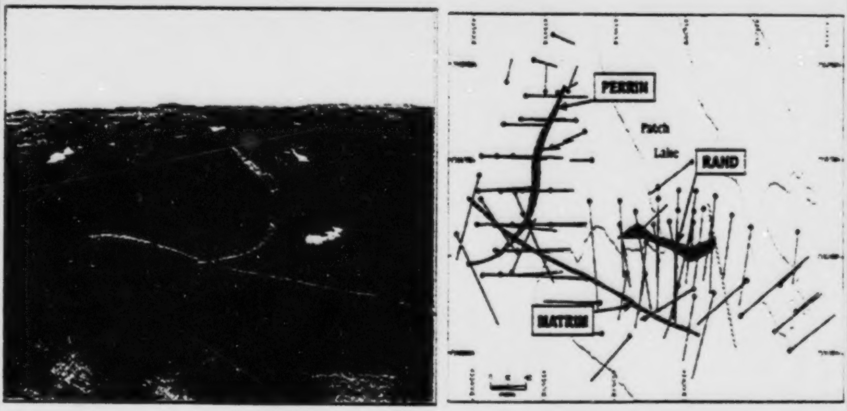
BOSTON GOLD PROJECT

B-2 3865m LEVEL @12320N

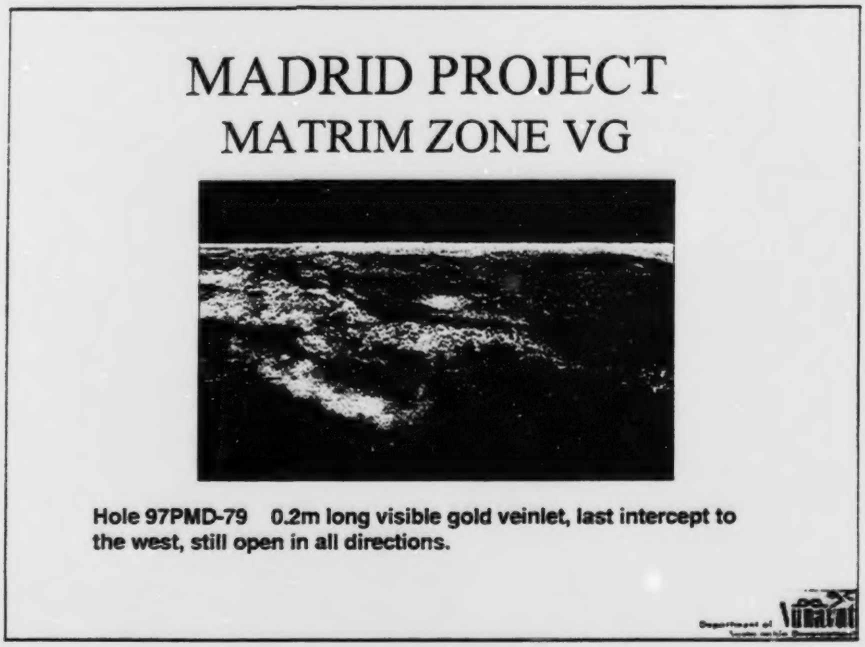


Department of Sustainable Development

MADRID PROJECT

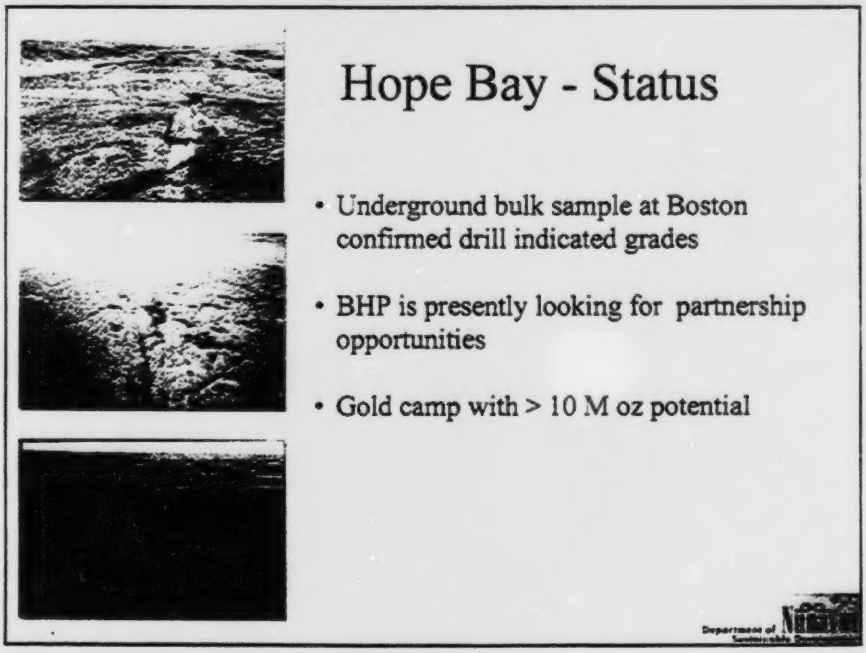

PERRIN
Patch
Lake
RAND
NATRIN

Department of Sustainable Development



MADRID PROJECT
MATRIM ZONE VG

Hole 97PMD-79 0.2m long visible gold veinlet, last intercept to the west, still open in all directions.



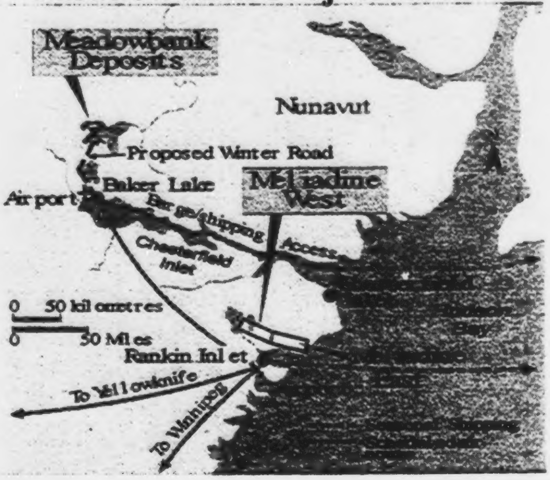
Hope Bay - Status

- Underground bulk sample at Boston confirmed drill indicated grades
- BHP is presently looking for partnership opportunities
- Gold camp with > 10 M oz potential

Meadowbank Gold Project

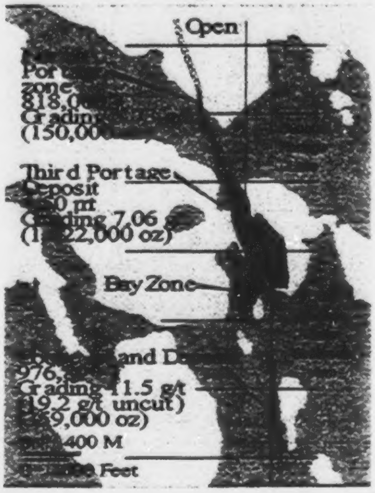
- Cumberland Resources
- 1997 resource base of 1.5 M oz (36% increase over 1996)
- 3 deposits on same horizon separated by 500m each
- Pre-feasibility in progress

Meadowbank Project Area


Meadowbank Deposits
Nunavut
Proposed Winter Road
Baker Lake
Airport
Meliadine West
Barge/shipping Access
Chesterfield Inlet
0 50 kilometres
0 50 Miles
Rankin Inlet
To Yellowknife
To Winnipeg

Meadowbank Gold Project

Third Portage Gold Trend

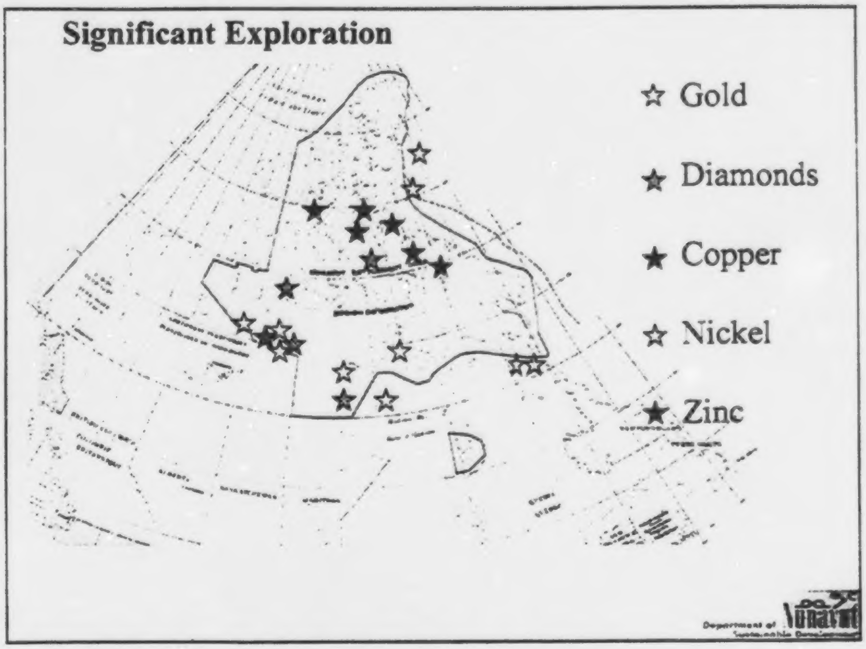

Open
Por
zone
818,0
Grading
(150,000
Third Portage
Deposit
0 pt
Grading 7.06 g
(1 22,000 oz)
Bay Zone
and D
976,
Grading 11.5 g/t
(19.2 g/t uncut)
9,000 oz)
400 M
Feet

Department of Nunavut

Izok Lake

- Inmet Mining Corp.
- 16.5 M tonnes @ 11.4% Zn, 2.2% Cu, 60 gpt Ag
- Project is presently inactive

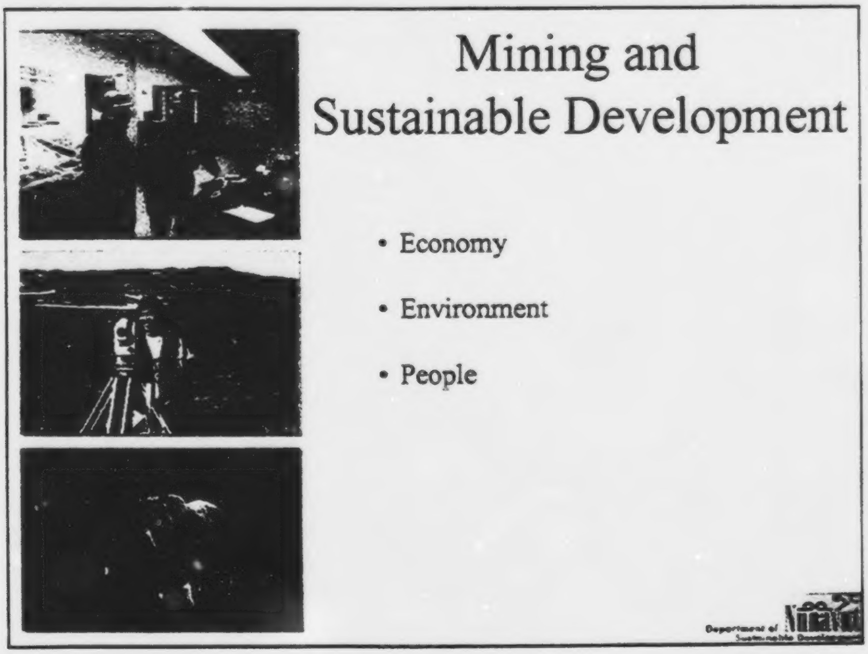
Department of Nunavut



Significant Exploration

- ☆ Gold
- ★ Diamonds
- ★ Copper
- ☆ Nickel
- ★ Zinc

Department of Sustainable Development Nunavut



Mining and Sustainable Development

- Economy
- Environment
- People

Department of Sustainable Development Nunavut

Tokyo Mining Investment Conference
February 16-17, 1999

CANADA-A WINDOW ON GLOBAL MINING
World-Class Technology and Investment Prospects

Mining and Aboriginal Issues: The Nunavut Territory

Presentation by
Charlie Lyall, President
Kitikmeot Corporation,
Cambridge Bay, Nunavut
Canada

Charlie Lyall

President, Kitikmeot Corporation
Kitikmeot Region of Nunavut, Canada

Mr. Charlie Lyall was born and raised in the Kitikmeot, and Taloyoak is his permanent home. From his office in Taloyoak, he maintains a "community perspective" on economic development and oversees development activities in the Kitikmeot and across Nunavut and the Northwest Territories. During the last eight years he has served on the Taloyoak town council as a councillor and Mayor.

As the Kitikmeot Inuit Associations' Secretary-Treasurer and Taloyoak Community Representative between 1987 and 1992, Charlie played an instrumental role on behalf of the Kitikmeot leading up to the signing of the Nunavut Lands Claim Agreement in 1993.

The Kitikmeot Inuit Association appointed him to the Nunavut Trust Board of Directors to represent their interests and ensure that the proceeds from the lands claims settlement from the Government of Canada are invested astutely on behalf of all Nunavut beneficiaries, including the Kitikmeot Inuit.

Since 1993, Mr. Lyall has been the President of the Kitikmeot Corporation. His corporation's mandate is to create a strong economic base for the Kitikmeot, by investing in business ventures that will lead to employment, training and business opportunities for Inuit, and negotiating strategic alliances that will strengthen corporate knowledge and capacity.

Mr. Lyall is a long serving director of Nunasi Corporation, and the Kitikmeot Corporation/Nunasi joint venture subsidiary Nuna Logistics – an Inuit firm recognized for its expertise in building roads and infrastructure in remote areas of Canada's north.

He is also a director of several other mining related joint ventures including Kitikmeot Geosciences Ltd. and Aboriginal Diamonds Group Ltd. The former is a prominent Nunavut based geosciences firm in the mining industry that offers environmental and mine exploration services to industry and government. The latter is the parent company of Diamonds International Canada Ltd. – the joint venture company that was awarded the Canadian Government Diamond Valuation contract for Canada's first producing diamond mine - BHPs' Ekati.

Ladies and Gentlemen,

It is my great honour and privilege, as the President of Kitikmeot Corporation, to have been invited to address you at this conference on the eve of the creation of the Nunavut Territory in Canada.

Elections for the first Nunavut Legislative Assembly were held on February 15 and the elected officials will begin governing on April 1, 1999.

This is a very historic event for Inuit and represents nearly 25-years of discussions and negotiations with the Government of Canada.

Nunavut is a vast territory whose 26,000 citizens live in 27-communities, ranging in size from 140 to 4000 people. The most common inter-community mode of travel is by airplane. The only highway in Nunavut (21 kilometers) is between Nanisivik and Arctic Bay.

It is a large area of over 2,000,000 square kilometers, and it covers one-fifth of Canada's landmass. It would take me almost 4-hours by jet to fly from Cambridge Bay to Iqaluit, the Capital of Nunavut, and the seat of the new government.

It has been described as Canada's last frontier, and is an area of Canada that remains largely untouched and undeveloped because of its remoteness and harsh climate.

With this backdrop, Kitikmeot Corporation, and business partners look forward to the challenges of developing business ventures and mining opportunities in Nunavut – this in Inuktitut means "our land."

In particular, we believe strongly that significant development opportunities exist for our base minerals resources -- copper, zinc, lead, nickel -- as well as precious metals like gold and silver, and the platinum metals group.

It is in the context of my opening remarks that I am here today to tell you about my corporation, Inuit land claims, the mining opportunities, access to the resources, joint venture businesses, and our relationships to governments.

The Nunavut Final Agreement was signed between the Inuit of Nunavut and the Government of Canada in May 1993, completing nearly 18-years of negotiations and bringing a degree of certainty and stability to the future of Inuit and Nunavut.

There are two articles in the agreement that I will highlight for you, and their impact on Nunavut.

Article 4, called Nunavut Political Development, bound the Government of Canada to "recommend to Parliament, as a government measure, legislation to establish, within a defined time period, a new Nunavut Territory, with its own Legislative Assembly and public government, separate from the Government of Canada and the remainder of the Northwest Territories."

Our hard work is soon to become reality on April 1 with the establishment of Nunavut.

There will be tremendous strategic opportunities within the first few years for international companies and governments to forge alliances and develop trade agreements with the Nunavut Government and businesses in the new territory.

Inuit Impacts & Benefits Agreement, Article 26, is of particular importance to the Kitikmeot Corporation. Prior to signing the Land Claims Agreement there was very little opportunity for Inuit businesses to be involved with mining companies in the development of mineral resources in Nunavut.

This article changed this for the benefit of Inuit and the mining industry as well. It clarified the rules for mineral resource development in Nunavut and the expectations of the Inuit with respect to active participation in the industry.

Article 26 requires developers intending to develop a major project such as a mine, which involves the exploitation of resources, to notify our Regional Inuit Associations of their intent to negotiate an IIBA.

It is very clear about the types of benefits Inuit will seek from mining companies. In most instances, Inuit are seeking benefits relating to employment, training, education, scholarships, business opportunities, contracting and sub-contracting.

The signing of an IIBA is important to Inuit. It provides an opportunity to share in a mining development that will yield significant benefits. It ensures that there will be controlled development of mineral resources, protection of the environment and wildlife in the areas affected by a mine, protection of Inuit culture and traditions, fishing and hunting, a retention of economic benefits.

Inuit Birthright Development Corporations

The Kitikmeot Corporation is the wholly owned business development subsidiary of the Kitikmeot Inuit Association, our parent political organization.

We are responsible for the economic interests of Inuit in our region of Nunavut. The two other regions of Nunavut also have development corporations that are similar to ours in design and operation, and which are owned by their respective political organizations.

Our corporations receive the financial proceeds that flow from the Land Claims Agreement with the Government of Canada. We use them for economic development and business development, and we invest them on behalf of the Inuit who are our shareholders.

We are entering an era where Inuit intend to become full and active partners in development of our mineral resources.

The Kitikmeot Corporations' corporate strategy and mission statement guides our business and investment activities. Some of the principles in our strategy that we apply to guide our efforts to build a solid financial and economic foundation are:

- Placing investments that will ensure that Inuit have every opportunity to become significant stakeholders in shaping the economic and business climate in the Kitikmeot.
- Invest in or develop business ventures that will create opportunities for Inuit in the Kitikmeot.
- Develop and strengthen relationships with governments, Inuit owned corporations, and economic development agencies throughout Nunavut, where the results of such relationships would result in increased business and economic opportunities in the Kitikmeot and Nunavut.
- Develop and strengthen relationships with other businesses in Canada and globally, that would result in bringing valuable technical and management skills, and financial resources to the Kitikmeot.

We do not pursue economic and business opportunities or investments that will place our Land Claims proceeds at risk.

We seek solid business deals that will provide jobs and training for Inuit – either directly or indirectly through other activities generated by reinvesting our profits in Nunavut.

We manage our Land Claims funds with care, choosing investments that will provide us with a good rate of return while limiting our downside risk.

The Kitikmeot Corporation is committed to building a strong corporate foundation from which we can pursue the business and economic opportunities that will arise in Nunavut in the next few years.

We have made this a high priority in order to attract reputable business partners and investors, and earn the confidence of financial institutions.

Investment in Joint Ventures and Businesses in the Mining Industry

Our corporation is very active in the mining industry through a number of strategic joint ventures. Our joint ventures are positioned to play an important role in the exploration, construction, and production phases of a mine.

Nuna Logistics

Through Nuna Logistics, we are able to construct winter roads, all weather roads, frozen core dams and runways, or airstrips for airplanes. The company has been in business for six years and has a full fleet of heavy equipment including trucks, bulldozers, graders, excavators, and other support equipment. The company enjoys an excellent reputation in Northern Canada, and played an important role in the construction of the BHP Ekati diamond mine north of Yellowknife.

Kitikmeot Geosciences

Our two-year old company, Kitikmeot Geosciences, offers a broad range of services to the mining industry. The company can provide services in exploration geology, geophysics, mineral research, drilling, environmental resources, GIS (Geographic Information Systems), mine engineering and logistical support. The company is at this conference with us and has a display set-up to demonstrate some of its services and new technology being offered to the industry.

Kitikmeot Caterers

Our catering company, Kitikmeot Caterers, is positioned to provide full camp management and catering services to mine companies in exploration or in full production. The company is capable of providing services to mines of up to 900 people, such as the BHP Ekati. The company held the catering contract at Echo Bay Mines' Lupin Mine until it "temporarily closed" last January 1998 due to the low price for gold. It continues to provide reduced services at that mine.

Aboriginal Diamonds Group

Our Aboriginal partners, Nishi Khon Enterprises and Deton Cho Development Corporation, formed Aboriginal Diamonds Group early last year to participate in the developing diamond industry in Canada's north. We are targeting opportunities in the secondary diamond industry such as cutting and polishing, jewellery making, purchase of rough. We have the support and encouragement of the Governments of Canada and the Northwest Territories in pursuing these opportunities.

Diamonds International Canada Ltd. (DICAN)

We formed Diamonds International Canada Ltd. as a joint venture between Aboriginal Diamonds Group Ltd. and WWW International Diamonds from London, England. Our company responded to the Canadian Government Diamond Valuation contract to value the diamonds from the BHP Ekati diamond mine that opened last October. Our proposal was successful, and we won the 3-year valuation contract over six other international companies.

Mineral Potential in the Kitikmeot

Izok Project

The Izok Project, owned by Inmet Minerals, is one of the largest undeveloped base metal deposits in North America. It hosts zinc-copper deposits, with a proposed pit operation life of 15 years. It is located about 150-miles south of the Arctic Coast and 55-miles west of Echo Bay Mine's Lupin mine site.

Considerable development work was invested by Inmet into the project, including 14-months negotiating an Inuit Impact & Benefits Agreement with the Kitikmeot Inuit Association.

Because of its remoteness, the only way to access the mineral deposit would be the construction of a road to a deep-sea port on the Arctic Coast. Unfortunately, due to declining metals prices and the expensive costs of constructing infrastructure the project was suspended in September 1994.

Muskox Property

The Muskox Intrusion is located about 45-miles south of Kugluktuk on the Arctic Coast.
It was first discovered in 1956.

The Muskox Nickel-Copper / Platinum Group Element deposit in Kitikmeot remains significantly under-explored. However, due to recent advances in ore modeling and geophysical technologies, facts are emerging that point to the Muskox Intrusion as a world-class deposit, similar in size, composition and geological environment to Voisey's Bay in Labrador, Noril'sk in Siberia, and Jinchuan in China.

In 1998, a summer field exploration program was conducted from July 20 to August 18, 1998 over the Muskox Intrusion by Kitikmeot Geosciences.

As in the case with the Izok Project, a road and deep-sea port would enhance the economic potential of this deposit.

Representatives of this property are here at the conference and will be able to explain the details of the property with you.

Unlocking the Mineral Potential in Kitikmeot

The Kitikmeot area of the Slave Geological Province has one of the most mineral rich geological settings in the world. The development of many mining properties in the area has been hindered only by the remoteness of these mineral deposits.

The absence of infrastructure to transport mine consumables, such as fuel and supplies, into the project sites, and the eventual exportation of concentrate(s) makes exploration and project development a very expensive proposition.

The Kitikmeot Corporation and the mining industry believe that if an arctic port(s) and road network(s) were established and strategically routed, the presently defined mineral deposits would become economically viable projects.

From our discussions with the mining industry we believe that if a port and road were developed, mining and mineral development in the Slave Geological Province would not be as affected by market volatility and recessed metal (commodity) prices.

There would also be many spin-off benefits in the form of increased mineral exploration, and many other secondary economic benefits to the Kitikmeot, including imports of inexpensive fuels and bulk materials for communities that could reduce our high cost of living.

For many of these reasons, the Kitikmeot Corporation joined in partnership with the mining industry and agencies of the Government of Canada and the Northwest Territories to undertake and complete a Bathymetry Survey of the Bathurst Inlet.

Detailed bathymetry studies over two-summer sailing seasons at a total cost of $1,700,000 proved to us that it was possible for deep-sea vessels to navigate to a potential port site at the bottom of the Bathurst Inlet.

The initial results from the 1997 season encouraged the Government of the Northwest Territories to commission three separate studies in 1998 to consider the preliminary socio-economic, environmental, and route mapping aspects of constructing a road from Yellowknife to the Bathurst Inlet and the proposed port site.

We are waiting for the conclusion of these studies, and the valuable information data they will contain. It will help us in assessing the economic viability of constructing road and port infrastructure that is entirely Kitikmeot based.

Regional Development Agency

An important initiative that is currently under development in Canada's north is a joint Aboriginal-Industry study to design a model for a Regional Development Agency.

Last summer nearly 100-representatives of Aboriginal corporations and resource companies met in Yellowknife to discuss problems and solutions to the development of non-renewable resources in Canada's north.

We prepared a report with our recommendations and presented it in October to the Minister of the Department of Indian Affairs and Northern Development.

Her response was enthusiastic, and she asked our group to develop a turnkey Regional Development Agency model for the north that her department could review for possible implementation

Our study is currently underway and it will be complete by the end of March for presentation to the Minister.

One of the important structural items that we are considering is establishing an independent agency with members drawn from the Aboriginal corporations and non-renewable resource sector firms.

The Regional Development Agency would be funded entirely by government, with funding decisions made to fund projects in categories such as:

- Equity participation in mining.
- Transportation subsidies for employee travel to remote sites.
- Due diligence studies on investments.
- Assistance to provide mine training.
- Assistance to provide training to build Aboriginal corporate capacity.
- Geosciences studies.

We estimate that an annual budget of $6-$8 Million dollars a year will be required for the agency to fulfil its mandate.

Conclusion

In summary, I have tried to convey the message that Nunavut is open for Business and have many desirable variables in our favour. We have:

- Settled Lands Claims Agreement.
- Creating our own Nunavut Territory on April 1, 1999.
- Birthright development corporations that with strong corporate capacity and relationships with governments and Inuit political organizations.
- Joint ventures and businesses strategically positioned to service the mining industry.
- Potential world class mineral deposits.
- Initiatives underway to promote the concept and development of road and port infrastructure to unlock the Mineral Potential in the Kitikmeot.
- Participating in the study to establish a Regional Development Agency.

We welcome you to participate with us in realizing the potential of our resources and developing our new Territory of Nunavut.

Thank you.

Investing in Saskatchewan

Donald Koop
Assistant Deputy Minister, Finance and Administration
Saskatchewan Energy and Mines

CANADA: A WINDOW ON GLOBAL MINING
World-Class Technology and Investment Prospects
Canadian Embassy, Tokyo, Japan
February 16, 1999

Mr. Donald Koop

Assistant Deputy Minister of Finance And Administration
Department of Energy And Mines

Donald Koop was born and raised in Winnipeg, Manitoba. He received his Bachelor of Arts (Honours) in Economics from the University of Manitoba in 1973 and his M.A. (Economics) from Carleton University in Ottawa in 1977. Donald worked for the Department of Finance and a number of other departments in the Saskatchewan Government from 1973 to 1995, at which time he assumed his current position of Assistant Deputy Minister of Finance and Administration with the Department of Energy and Mines. Donald is married and has two children.

Investing in Saskatchewan

Slide 1: Investing in Saskatchewan
Thank you Mr. Moderator:

It is a pleasure to be here today to speak at this conference. Before I begin my presentation, I would like to take this opportunity to say how much I have enjoyed Tokyo in the short time I have been here. I am looking forward to seeing more of your beautiful country during my brief visit.

Today I want to give you a brief overview of the mineral industry in Saskatchewan and the many opportunities for mineral investors.

Saskatchewan is a province in Canada with a land area that is almost twice the size of Japan's.

Slide 2: Saskatchewan Mines
The Saskatchewan mineral industry is a vital and important contributor to the provincial economy. As you can see from this map, the mining industry is active throughout the entire province.

Slide 3: Saskatchewan's Mineral Industry
Mining is the third largest industry in the province.

Slide 4: Value of Mineral Sales
The total value of mineral sales has grown significantly over the past five years despite the recent slump in commodity prices. The total value of mineral sales in Saskatchewan exceeded $2.3 billion Canadian in 1997.

Saskatchewan's mineral industry is one of the best in the world. The province is endowed with a rich and diverse variety of mineral resources. We believe that our province has many advantages to offer to prospective mineral investors.

Slide 5: Saskatchewan Advantage
To begin with, there is a high level of public support for the mining industry throughout the province. In northern Saskatchewan, the mining industry has brought welcomed economic activity and jobs to indigenous communities.

The Government of Saskatchewan is committed to mineral development. We have adopted an investor friendly and competitive framework to guide the responsible development of the province's mineral resources. The Government continually works with the mining industry to address concerns and to help make mining more efficient and productive. Last year we introduced a number of significant changes to the potash taxation system. The changes are expected to make the potash industry more competitive in world markets and encourage it to expand its productive capacity over the longer term.

Protection of the environment is important to Saskatchewan as it is to many jurisdictions across the world. The Government of Saskatchewan has set rigorous environmental standards, but we also have a co-operative and consultative approach to environmental issues. We believe that we have a timely and efficient process for obtaining environmental approval for mining projects.

Slide 6: Investing in Saskatchewan
In Saskatchewan there are highly productive and experienced suppliers and extensive support services for mineral development and exploration. We have low business costs, a skilled work force, world-class transportation infrastructures, and first rate geological services. The Government also maintains an extensive database of geological information that is available to the public.

Slide 7: Saskatchewan Successes
The last and most significant advantage is the quality and variety of our mineral resources. Many of you already know that Saskatchewan is home to two world-class mineral industries. Our potash and uranium industries are the largest in the world with each accounting for over 30 per cent of world production. Saskatchewan has large resources of both of these minerals and we will continue to supply world demand for many decades into the future.

The industry is planning to develop new potash and uranium productive capacity in Saskatchewan within the next five years. The capital investment of these expansion projects is valued at more than $1.5 Canadian billion.

Slide 8: Potash
Let me speak now about the importance of Japan to potash mining in Saskatchewan.

Slide 9: Potash and Japan
Japan was our first major offshore market for potash. Since 1962, Japan has purchased more of our potash than any other country outside North America. Japan is still our second largest offshore customer after China.

Slide 10: Uranium
Japanese interests were also involved in the early exploration for uranium in our province.

Slide 11: Uranium and Japan
The participation has continued through to the present day. A number of companies from Japan have also taken an equity interest in the new uranium projects in Saskatchewan. Some of the new projects have phenomenal ore-grades that average 13% or more. And there is considerable potential for the discovery and development of additional high-grade uranium deposits.

Your country is our second largest customer for uranium and we welcome your continued participation in the future of Saskatchewan's uranium industry.

Slide 12: Other Minerals
Many other minerals are currently produced in Saskatchewan.

Slide 13: Other Mineral Industries
Sodium sulphate, salt, coal, potassium sulphate, bentonite and peat are currently produced in southern Saskatchewan. Gold and base metals are currently mined in northern Saskatchewan.

Slide 14: Potential Developments
In addition to the previously mentioned minerals, the province has demonstrated mineral potential for ceramic clays, kaolin, silica sand, brines, building stone and diamonds. We estimate that there are about 25 different known mineral development projects in Saskatchewan. Many of these projects will hopefully be developed in the near future.

Slide 15: Gold and Base Metals
Perhaps the most exciting aspect about the Saskatchewan mineral industry is its untapped mineral potential. In addition to the known projects, there is the potential for many more developments. Northern Saskatchewan, in particular, offers several areas of high mineral potential. There are large areas of northern Saskatchewan that are relatively unexplored for gold and base metals. Both industry and the government believe that there is excellent potential for significant discoveries. Preliminary results from some of the exploration programs are very promising.

Slide 16: Mineral Exploration
The mineral industry considers Saskatchewan to be an attractive place to explore. Exploration expenditures in our province have increased by 48 per cent since 1994. As the mineral potential of Saskatchewan becomes better known throughout the world, we expect exploration spending in our province to increase.

In closing, Saskatchewan has demonstrated its mineral potential through its world-class potash and uranium industries. The infrastructure and regulatory framework to support an active mineral industry are already in place. Most importantly, though, I want to emphasize the significant, untapped mineral potential of Saskatchewan.

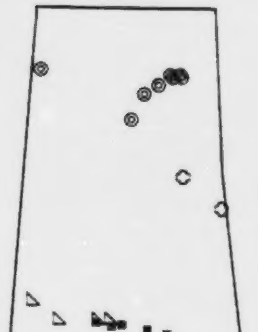
Slide 17: Investing in Saskatchewan
I invite you to come and invest in our province. Saskatchewan has a lot to offer.

Thank you for your attention and interest in the opportunities for mineral development in Saskatchewan.

Investing in Saskatchewan

Donald Koop
Assistant Deputy Minister
Saskatchewan Energy and Mines

Saskatchewan Mines

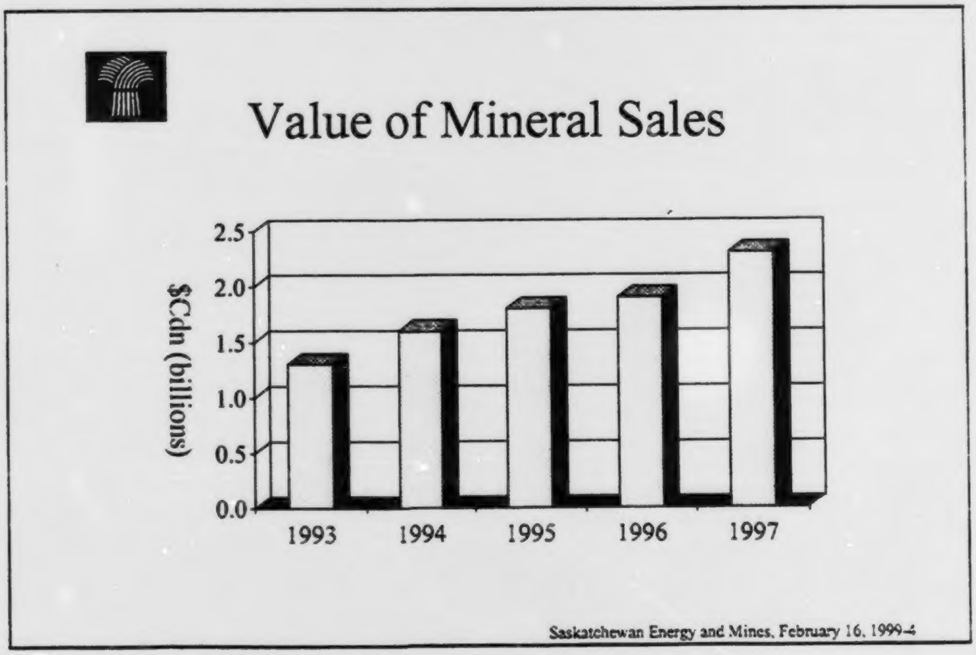


- ◎ Uranium
- ○ Gold and Base Metals
- ▪ Potash
- ▵ Coal, Sodium Sulphate, Salt, Clay

Saskatchewan's Mineral Industry

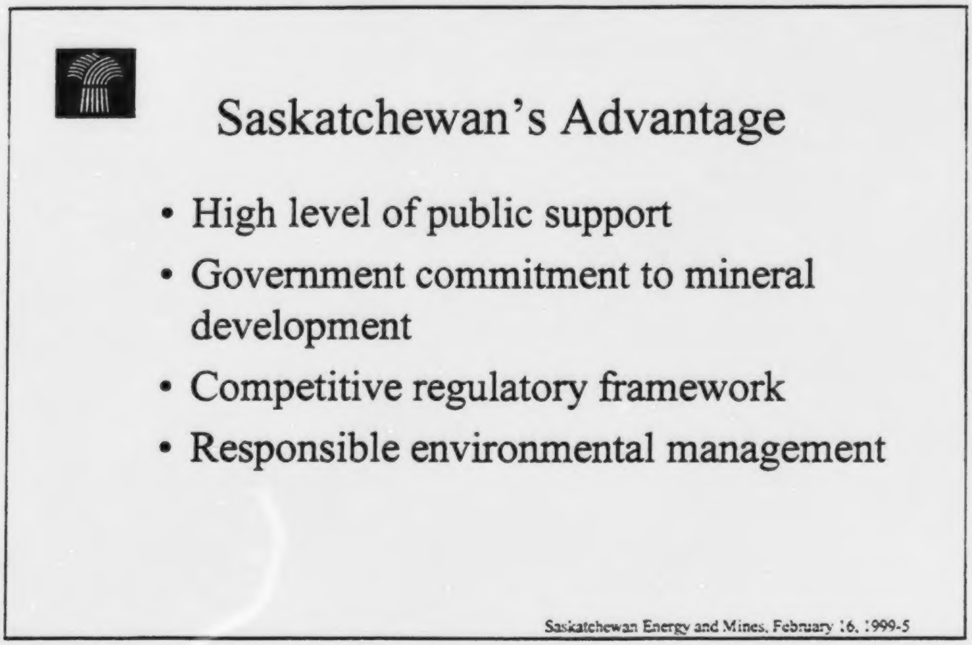
- Important to the economy
- Third largest industrial sector
- Fourth largest mineral producing province in Canada

Saskatchewan Energy and Mines, February 16, 1999-3



Value of Mineral Sales

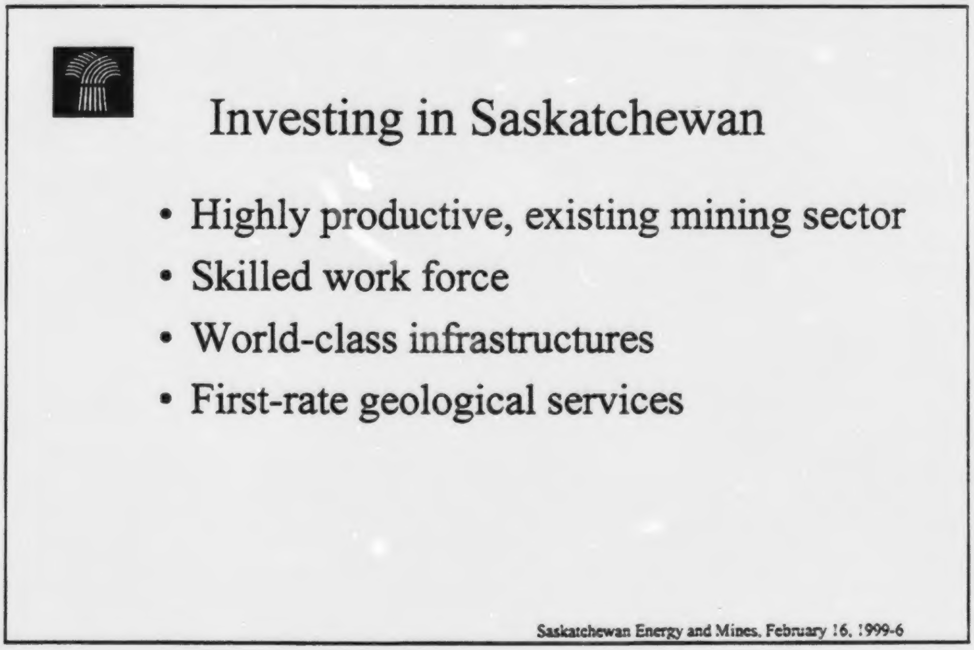
Saskatchewan Energy and Mines, February 16, 1999-4



Saskatchewan's Advantage

- High level of public support
- Government commitment to mineral development
- Competitive regulatory framework
- Responsible environmental management

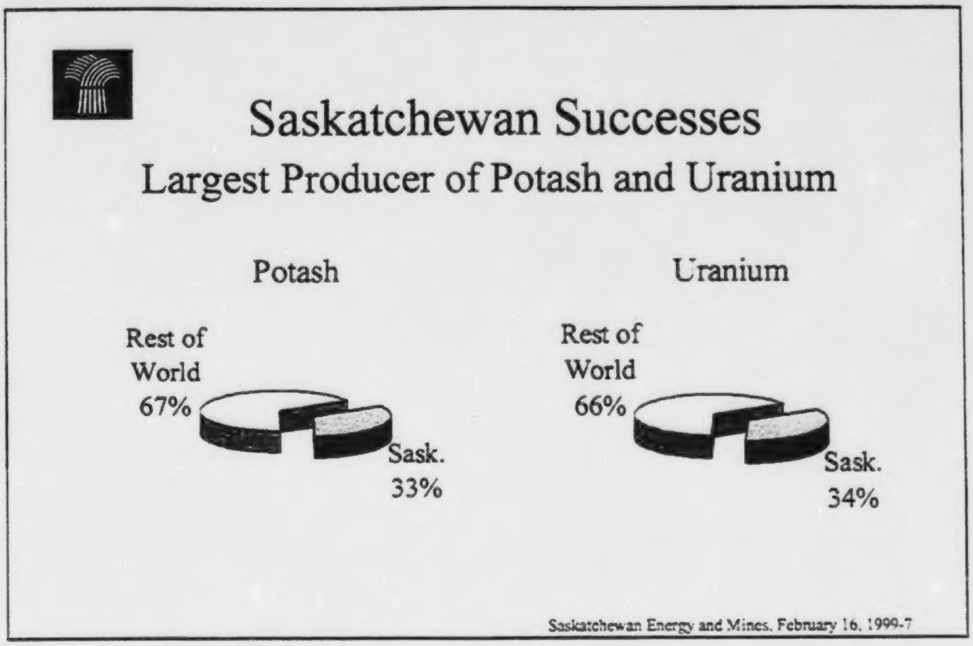
Saskatchewan Energy and Mines, February 16, 1999-5



Investing in Saskatchewan

- Highly productive, existing mining sector
- Skilled work force
- World-class infrastructures
- First-rate geological services

Saskatchewan Energy and Mines, February 16, 1999-6



Saskatchewan Successes

Largest Producer of Potash and Uranium

Potash

Rest of World 67%

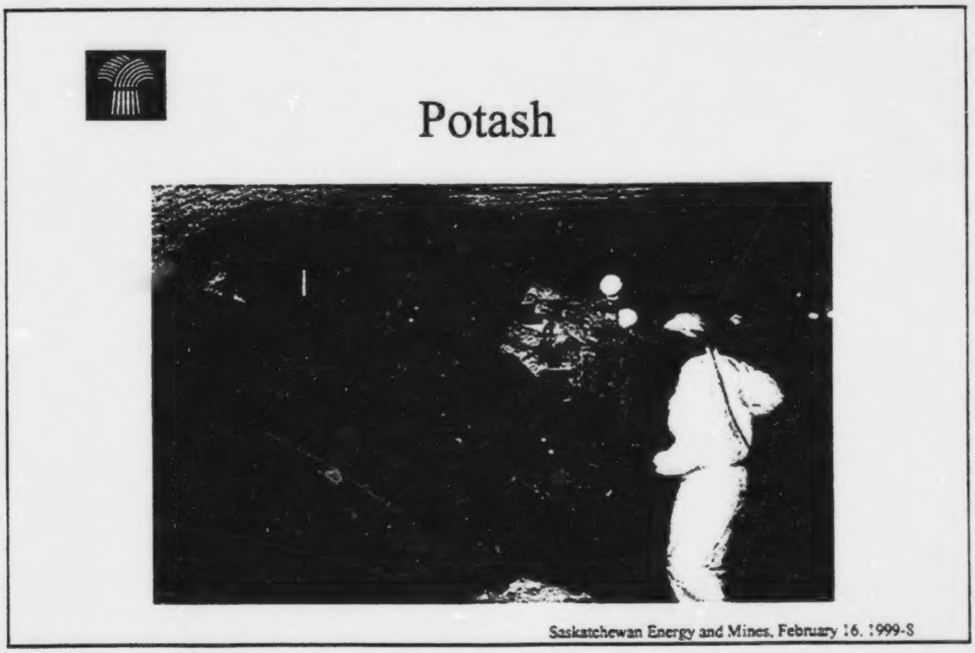
Sask. 33%

Uranium

Rest of World 66%

Sask. 34%

Saskatchewan Energy and Mines, February 16, 1999-7



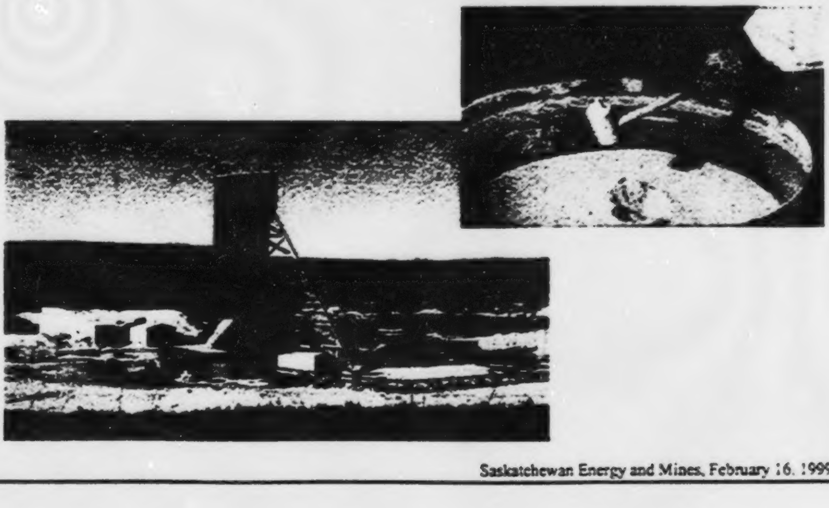
Potash

Saskatchewan Energy and Mines, February 16, 1999-8

Potash and Japan

- Japan is an important customer for Saskatchewan
- Japan has purchased more Saskatchewan potash than any other customer outside North America
- Japan is our second largest offshore customer after China

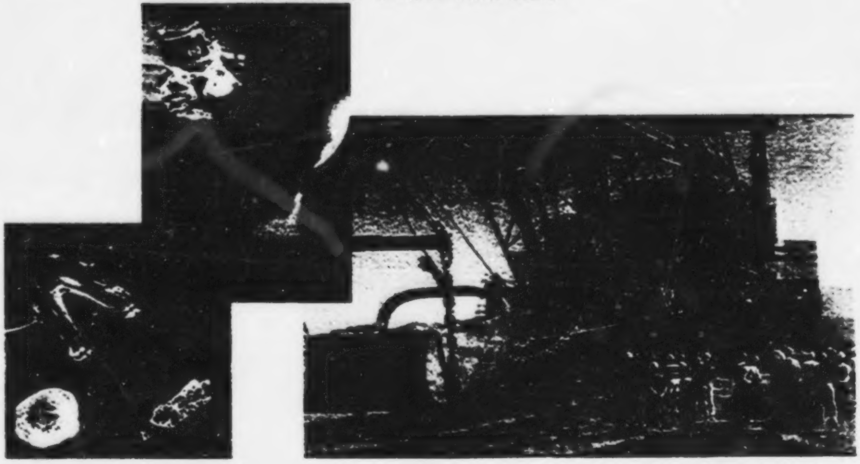
Uranium



Uranium and Japan

- Japan was involved in Saskatchewan uranium exploration for many years
- Japanese companies have equity interests in new mine developments
- Japan is Saskatchewan's second largest customer for uranium

Other Minerals

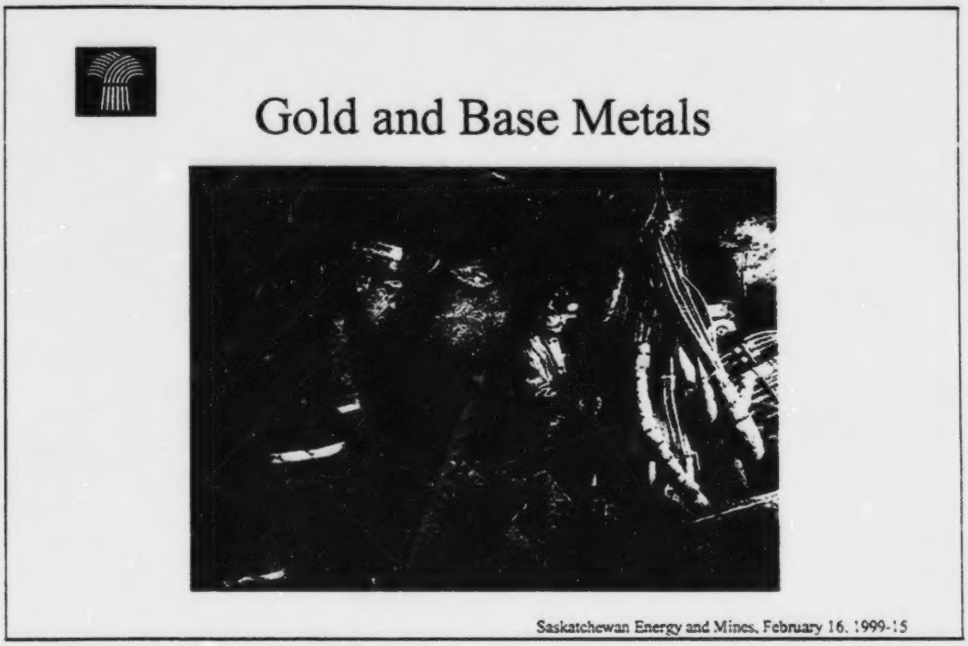


Other Mineral Industries

- Sodium Sulphate
- Salt
- Coal
- Potassium Sulphate
- Bentonite
- Peat
- Gold and Base Metals

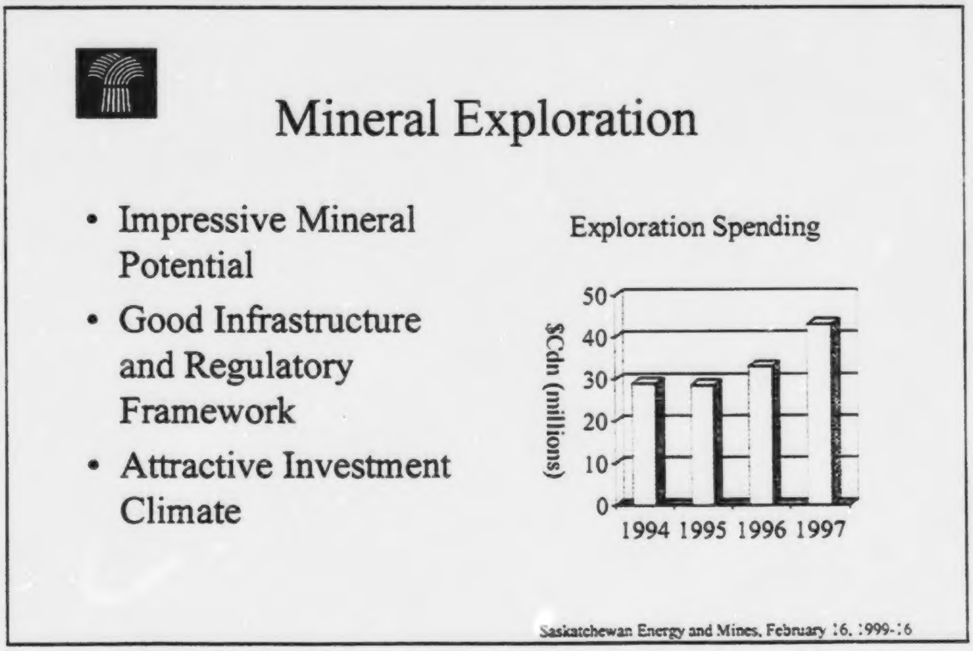
Potential Developments

- Ceramic Clays
- Kaolin
- Silica Sand
- Brines
- Building Stone
- Diamonds
- Gold and Base Metals



Gold and Base Metals

Saskatchewan Energy and Mines, February 16, 1999-15



Mineral Exploration

- Impressive Mineral Potential
- Good Infrastructure and Regulatory Framework
- Attractive Investment Climate

Exploration Spending

Saskatchewan Energy and Mines, February 16, 1999-16

Investing in Saskatchewan

Saskatchewan has a lot to offer

Come and talk with us

The Quebec Mining Industry: A Profitable Investment

Mr. Duc Vu
Associate Deputy Minister (Mining)
Ministry of Natural Resources

CANADA: A WINDOW ON GLOBAL MINING
World-Class Technology and Investment Prospects
Canadian Embassy, Tokyo, Japan
February 16, 1999

Mr. Duc Vu

Associate Deputy Minister of Mines
Department of Natural Resources
Government of Quebec

With an undergraduate degree in physics engineering and a master's degree in applied science, Mr. Vu has held a variety of positions in both the private sector and the Quebec public service.

He was formerly employed by Dupont Canada and subsequently, he was a manager with the provincial Treasury Board.

He has been a senior executive in the provincial public service since 1987, serving successively as Assistant Deputy Minister in the Health and Social Services, and in the Labour and Employment Training sectors. In September 1995, Mr. Vu was appointed Associate Deputy Minister of Mines in the Quebec Department of Natural Resources.

The Quebec mining industry and the Government of Quebec have worked out a unique and innovative partnership formula to preserve and consolidate the industry's contribution to the development of Quebec and its regions.

The Quebec Mining Industry: A Profitable Investment

Slide 1: Mining in Québec

- Québec is a major mineral producer at the world level
- Having an excellent potential, Québec offers numerous advantages to investors.

Slide 2: Mining in Québec

- 35 mines are currently in operation on Québec's territory,
- Some 400 quarries, sandpits and gravel pits; some forty peat producers.
- Québec's mineral production is highly varied: some thirty substances are produced.
- The main substances: iron, copper, zinc, gold, asbestos, titanium slag niobium, dimensional stone,...
- The total value of shipments is $3.5 billion, and mining investments have been about 1.0 billion per year over the last 4 years.
- Some 13,000 direct jobs in the mining industry and close to 40,000 jobs for metal and mineral processing industries as a whole.

Slide 3: Québec is a major mineral producer

- Québec is Canada's 2 nd biggest mineral producer and among the world's top ten producers.
- It is Canada's 2 nd biggest producer of gold, iron, metals, industrial minerals and building materials.
- Québec is the world's 2 nd biggest niobium producer.

Slide 4: Photo of a modern facility

- Québec's mining industry is modern: it uses state-of-the-art technology and invests in R&D to remain competitive.
- The mining industry and the metal and mineral processing industries spent more than $120 million in R/D in 1995.

- Moreover, companies show respect for the environment and are committed to sustainable development.

- According to the June 1998 environmental assessment of the AMQ, the global rate of compliance with environmental standards stood at 99 % in 1997, and everything points to a similar rate in 1999.

Slide 5: Québec offers (List of advantages)

- In a highly competitive context, Québec offers major advantages in the mining industry that are sure to interest knowledgeable investors.
  - An excellent mineral potential.
  - An accessible territory.
  - A reliable and advantageous mining regime.
  - Recognized know-how.
  - Major government support that takes a number of forms, including an advantageous tax system.

Slide 6: Proven potential

- Québec has a proven mineral potential, with a number of world class deposits being mined.

- 90 % of Québec's subsoil is made up of Precambrian rocks of the Canadian Shield: an environment that is known around the world for its gold, copper, zinc, nickel and iron deposits.

- Québec's geological contexts are varied and conducive to numerous types of mineralization.

- The work carried out by the MRN, SOQUEM as well as by junior and major companies have given rise to and offer the possibility of the discovery of numerous economically viable deposits.

Slide 7: Proven potential

- Québec's mineral potential and the economic profitability of its mining sector can be demonstrated in the following way:

- Since 1900, Québec has produced 58 million ounces of gold, 6 million tonnes of copper, 6 million tonnes of zinc and 450 million tonnes of iron ore.

- For example, Québec's total gold production since 1900 corresponds to more than 5% of the total gold reserves of the world's Central Banks.

- In 1998, Québec's gold production (38 tonnes) corresponded to close to 30% of Japan's industrial gold consumption for that same year.
- Moreover, Québec's mineral potential is waiting to be discovered.

Slide 8: A vast territory (Québec in North America)

- Indeed, Québec is an immense territory open to mining and featuring high quality infrastructures.

Slide 9: A vast territory

- Québec's territory is immense: the total surface area is 1,7 million kM2

- The fact that 92% of this territory is made up of public lands is very noteworthy.

- When one considers the lands that are exempt from staking, 90% of Québec's territory is open to mining and exploration.

- There will be numerous business opportunities in the future as only 3% of the surface area is covered by mineral titles at the present time.

Slide 10: A vast territory

- On this vast territory, Québec is banking on the opening up of "new territories" of the Near-North and Far North which have an incredible mineral potential.

- Very promising work has been carried out in recent years on these territories (Geochemical survey of the Far North, geological mapping in the Near-North).

- Very promising work has been carried out in recent years on these territories (Geochemical survey of the Far North, geological mapping in the Near-North).

- In short, a large part of the territory has yet to be explored or has witnessed very little exploration; what's more even in the explored territory, only 6 % of the drillings have been below 200 metres.

- Moreover, major recent discoveries have been below 200 metres (Louvicourt, Bouchard-Hébert, LaRonde, Bell Allard).

Slide 11: An accessible territory (well developed infrastructures)

- This territory is accessible and is characterized by well developed and available infrastructures:
  - A dense road network with some 200,000 km of forest roads;
  - A well developed railway network;
  - A major seaway, with deep-water ports and offering access to markets located in North America, South America and overseas;
  - An airport network covering the entire territory; and
  - A hydroelectric network offering one of the lowest electricity prices in the world (3.5 cents per kW/h in 1997 for the industrial sector).

Slide 12: Reliable advantageous mining regime

- Québec has one of the most reliable mining regimes in the world because it is founded on legal bases that ensure a structured and coherent development of the mining industry.

- Québec's Mining Act promotes investments: it entrenches the principle of "Free mining", and companies do not have to worry about being able to mine their discovery.

- The regime is constantly being improved as the new Act and future regulations propose an improved management of titles, a reduction in conflicts and administrative simplification.

- For example, mention may be made of the replacement of staking by a more modern map-based designation system.

Slides 13&14: Recognized know-how

- The mining industry can count on recognized know-how and a large pool of highly qualified manpower.

- A geomining information system.

- The industry has several public and private research centres.

- 7 Québec universities offer specialized programs in mining engineering, metallurgical engineering and geology.

- Several hundred students register in these programs on an annual basis; about 180 graduates in 1994 (last year for which data are available).

- Québec's mining entrepreneurship is excellent: about 150 mining firms are listed on the Montreal Exchange.

Slide 15: Government support

- Active companies can count on strong government support in the mining sector.

- The Government of Québec and the ministère des Ressources naturelles support the activities and the development of the mining industry in a number of ways, including technical and financial assistance measures relating to:
  - prospecting and exploration;
  - research and development;
  - mineralogical trials and pilot projects;
  - technical-economic studies;
  - technological innovation;
  - marketing of products;
  - putting in place of road and electricity infrastructures; and
  - loan guarantees.

- Québec also offers a very advantageous tax system: R & D tax credits, the most advantageous mining royalty regime in Canada, flow-through shares promoting investments in exploration.

- Possibilities of partnership with SOQUEM, the SGF and Investissement Québec.

- In short, the mining industry and the Government of Québec are partners in harmonious and environment-friendly development.

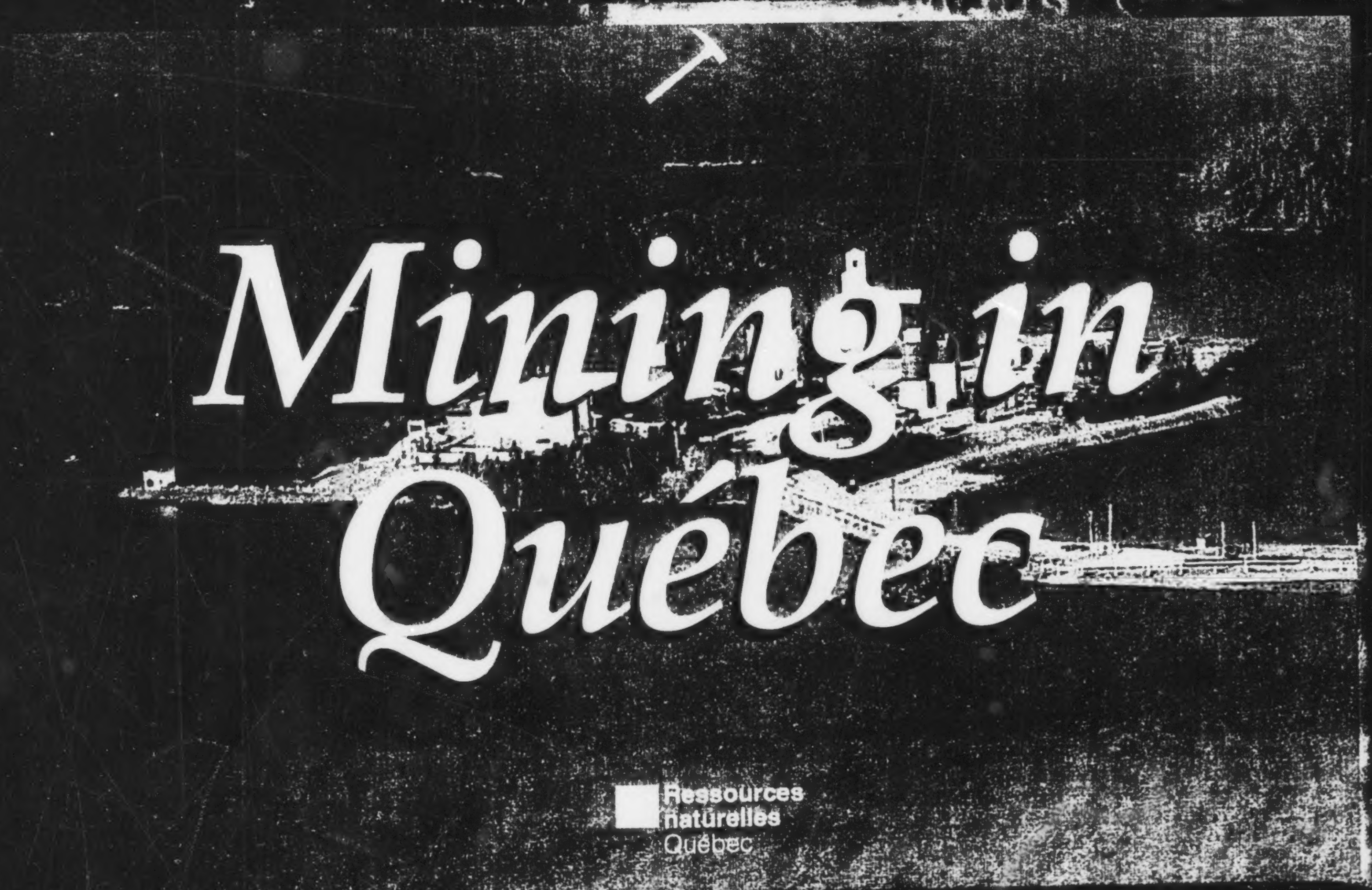
Slide 16: Québec offers

- Québec offers a stimulating business context for investors.

- Several projects are currently the focus of studies or works that point to, major deposits involving a number of substances.

- For example, mention may be made of vanadium, wollastonite, apatite, ilmenite, chromite, niobium, granite, and graphite.

- All these resources feature a potential world class survey.



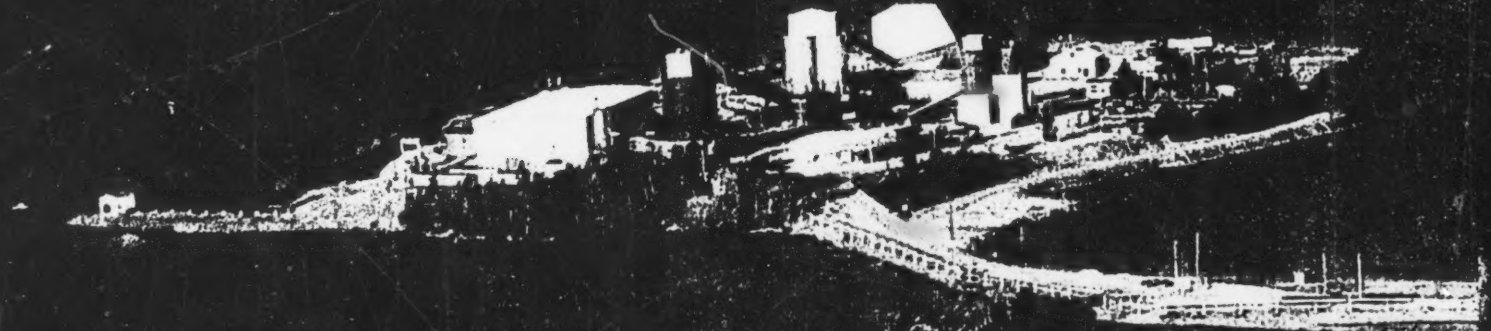
Mining in Québec

Ressources
naturelles
Québec

QUÉBEC *is*
a major producer

- 35 mines in operation
- 30 substances mined
- $3.5 billion in production in 1998
- $1 billion in investments in 1998

QUÉBEC *is* *a major producer*



- Canada's 2nd biggest mineral producer
- Among the world's 10 leading mineral producers

A MODERN *industry*

- **Implementation of state-of-the-art technologies**

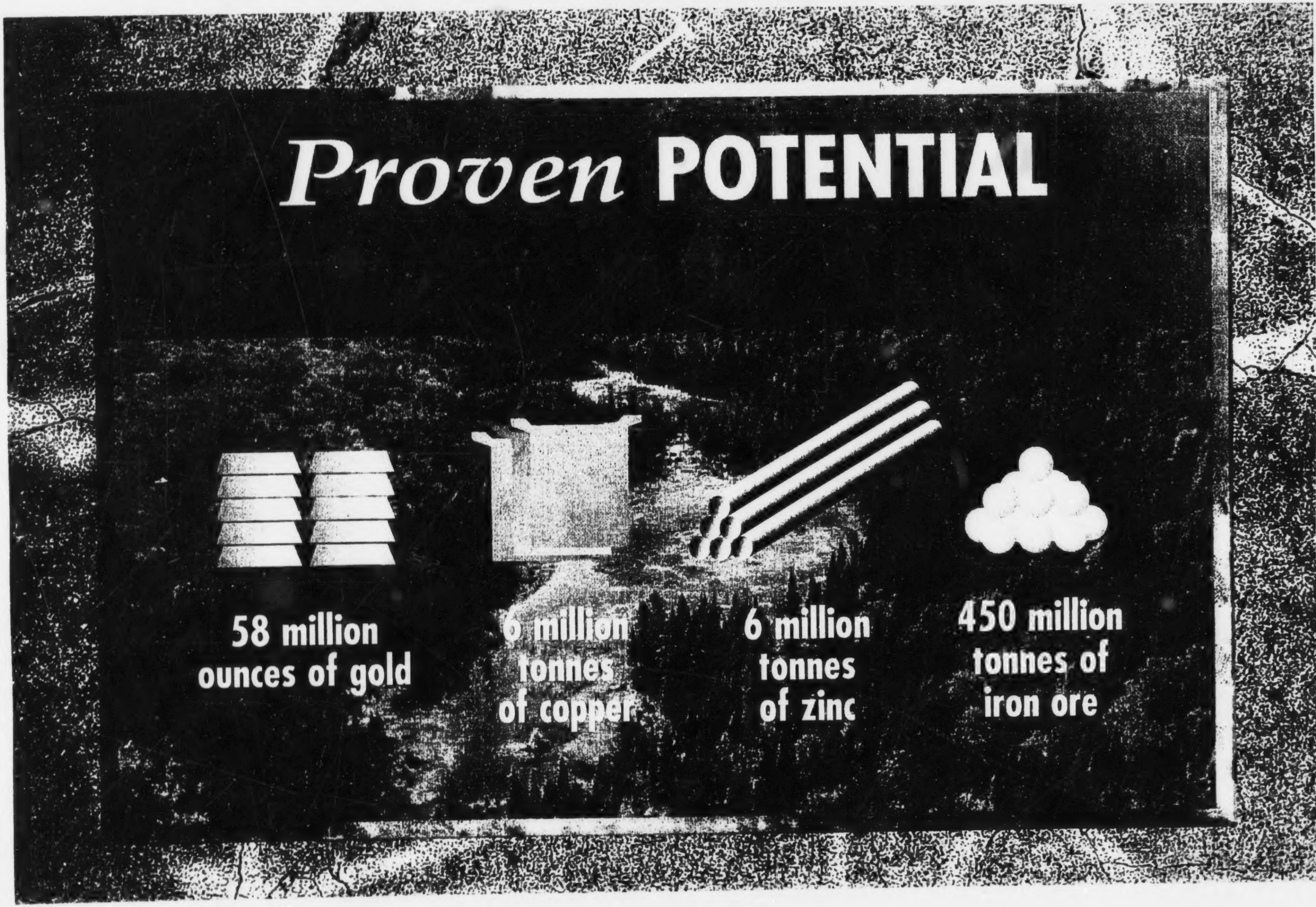
QUÉBEC *offers*

- AN EXCELLENT MINERAL POTENTIAL
- AN ACCESSIBLE TERRITORY
- A RELIABLE AND ADVANTAGEOUS MINING REGIME
- RECOGNIZED KNOW-HOW
- [illegible]

Proven POTENTIAL

- 90% of the undersoil
  is made up of Precambrian
  rocks of the Canadian Shield

- varied geological settings that are conductive
  to numerous types of mineralization



Proven POTENTIAL

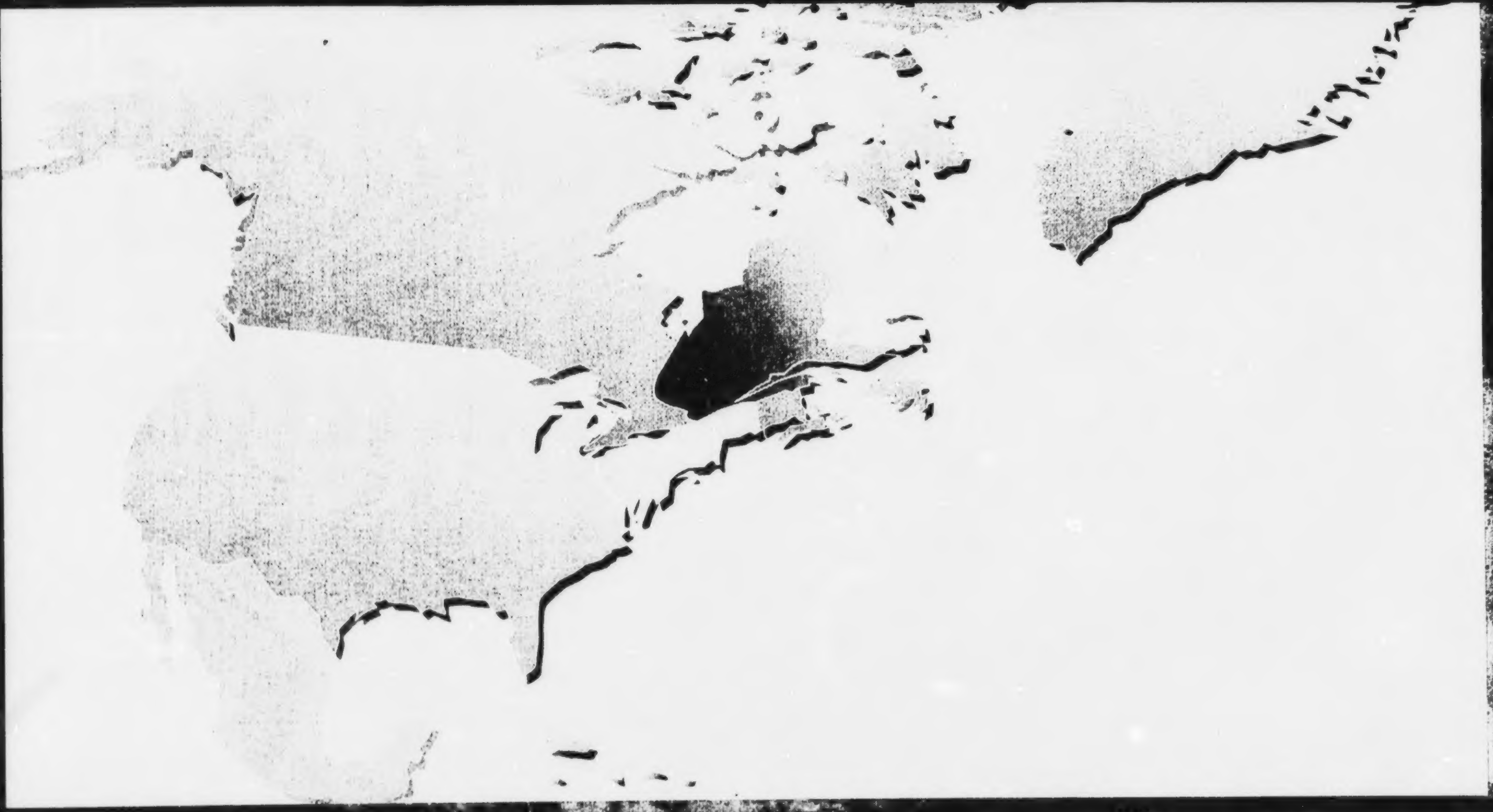
58 million
ounces of gold

6 million
tonnes
of copper

6 million
tonnes
of zinc

450 million
tonnes of
iron ore

A VAST *territory*



A VAST territory

- 1.7 million km^2
- 92% public lands
- 90% open to mining activity

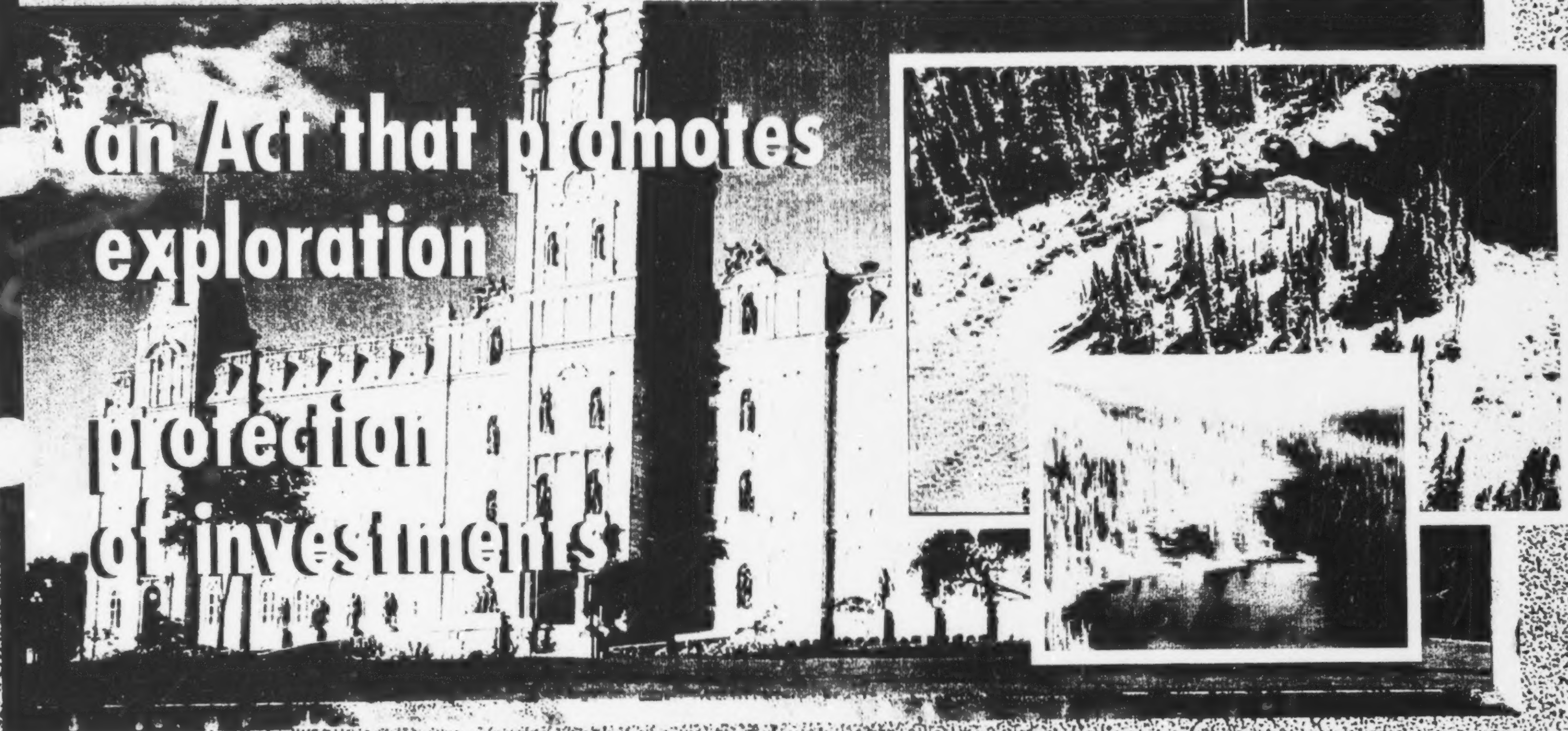
A VAST *territory*

- A proven mineral potential
- A territory [illegible] km in size open to mining
  - Far North
  - Near North

An accessible TERRITORY

Road network
Airport network
Port network
Rail network

MINING REGIME



an Act that promotes exploration

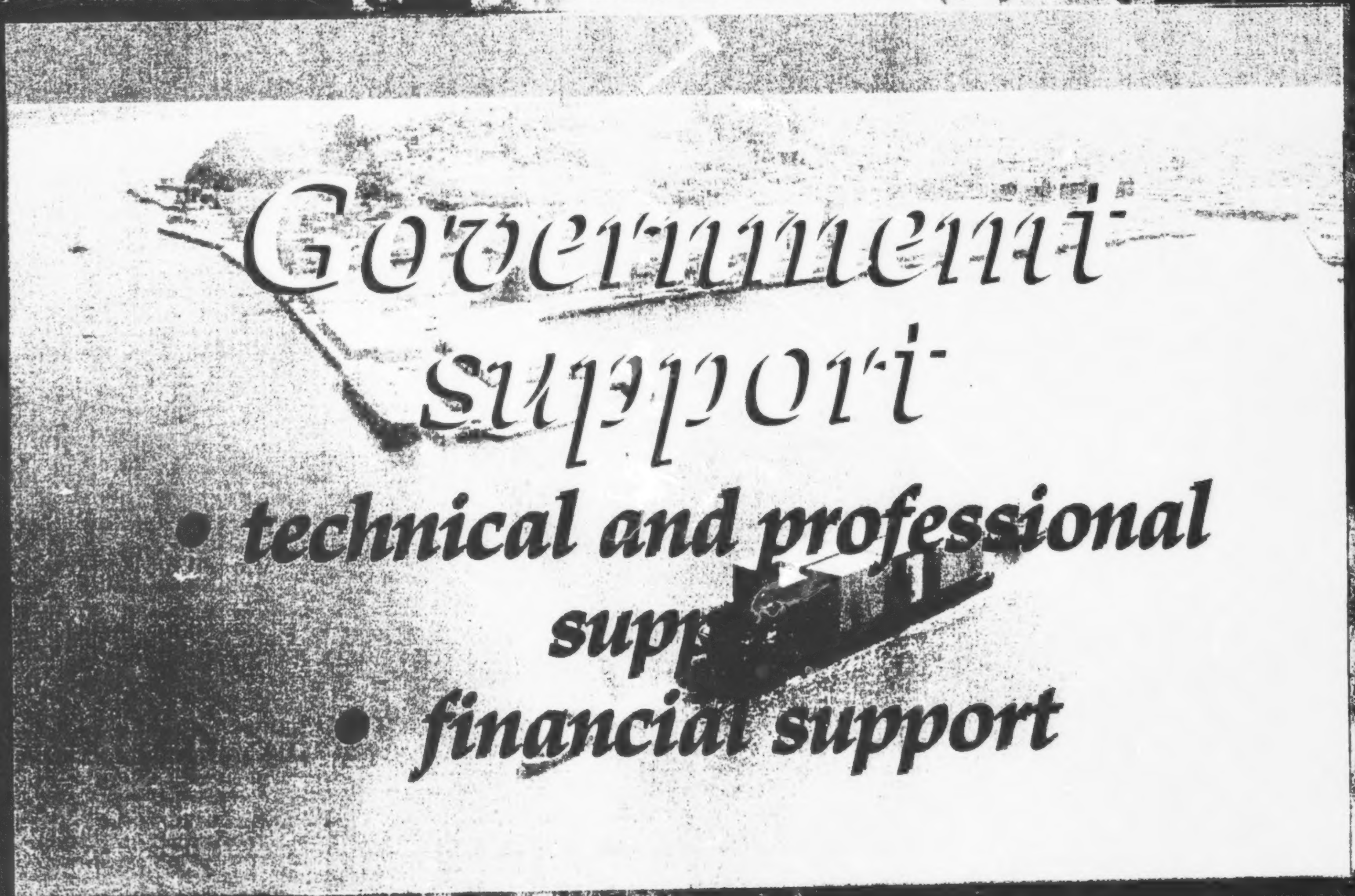
protection of investments

KNOW-HOW

several research centres
several universities and CÉGEPS
a specialized labour force
companies using modern
technologies

KNOW-HOW

In partnership, Québec contributes to the development of mineral technology



Government support

- *technical and professional support*
- *financial support*

Québec offers

- a stimulating business context
- a very advantageous tax structure for exploration

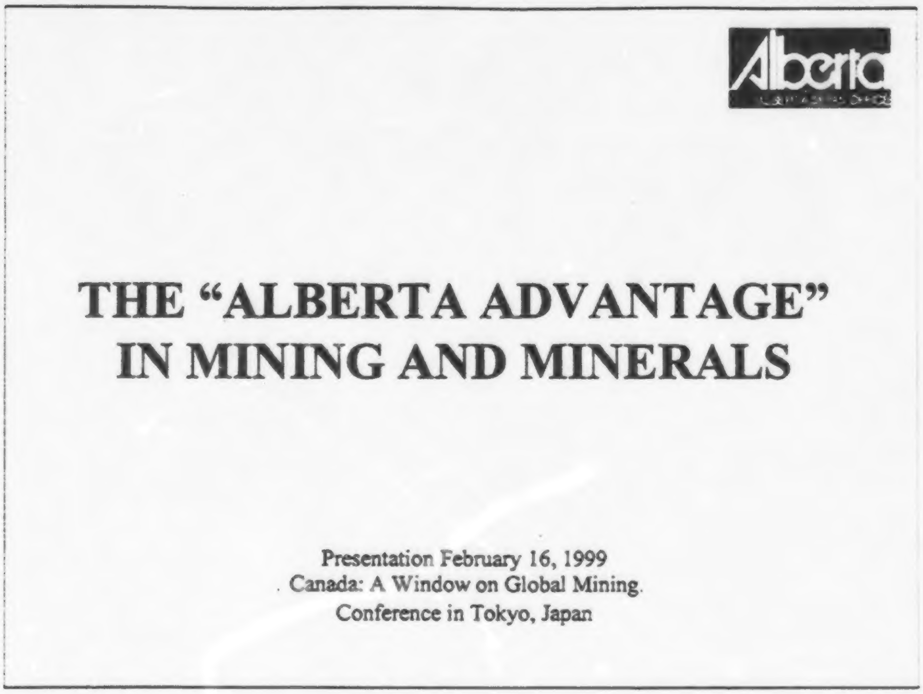
and can count on

- serious firms that have promising projects

The Alberta Advantage in Minerals and Metals

Mr. Brad Klak
Managing Director
Alberta Japan Office
Government of Alberta

CANADA: A WINDOW ON GLOBAL MINING
World-Class Technology and Investment Prospects
Canadian Embassy, Tokyo, Japan
February 16, 1999



THE "ALBERTA ADVANTAGE" IN MINING AND MINERALS

Presentation February 16, 1999
Canada: A Window on Global Mining.
Conference in Tokyo, Japan

You have already had the opportunity to hear from Alberta's colleagues on the broad and varied mineral resources and an infrastructure Canada is proud of.

My brief presentation this afternoon will provide information on Alberta's well-known and long-standing mining and mineral resources. I will also share with you some of the new and exciting opportunities in Alberta.

Alberta
ALBERTA JAPAN OFFICE

Alberta and Japan - A Long Relationship

- Alberta s #1 Offshore Trading Partner
- Exporter of Coking Coal Since 1960's
- Over 25 Years in Mining of Oil Sands & Coal

Alberta has had a long relationship with Japan, especially in the mining industry. Japan is Alberta's #1 offshore trading partner and accounts for more than 25% of Alberta's non- U.S.A. exports. We have been a reliable exporter of high quality hard coking coal to Japan since the late 1960's. Today, Alberta has new opportunities for investment in diamond exploration and other non-energy minerals.

Alberta and Japan have a long history in the mining industry. Japanese organizations have been our partners in developing Crown owned resources for many years. Japanese partners have been involved in oil sands development since 1974 - almost as long as the Alberta Government.

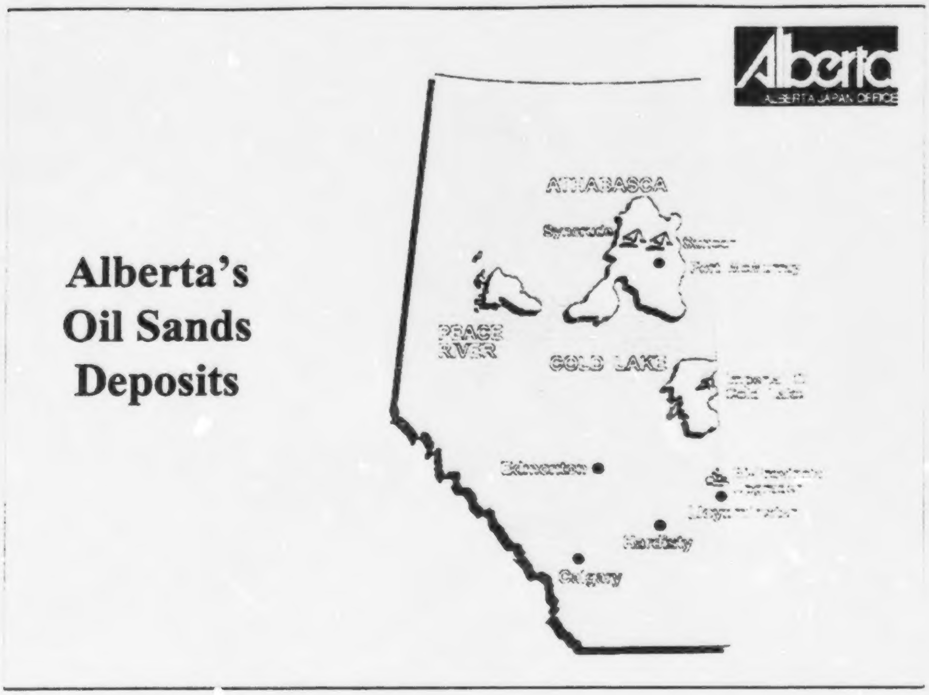
Alberta and Japan . . continued

- Over $300 Million Spent in Mining
- Pilot Projects and New Technologies:
  - Underground Test Facilities (U.T.F.)
  - Steam-assisted Gravity Drainage (S.A.G.D.)

Japanese partners have invested over $300 million in developing coal mines, oil sands and upgraders; which includes the Lloydminster project.

Japanese companies have invested in new technology and research as partners in Underground Test Facility (U.T.F.) projects and in piloting Steam-Assisted Gravity Drainage (S.A.G.D.) projects.

Japanese investors in these sectors continue to enjoy the benefits of the wealth of resources in Alberta.



Alberta
ALBERTA JAPAN OFFICE

Alberta's Oil Sands Deposits

This slide provides a geological perspective of Alberta's biggest strength, our oil sands. Alberta's oil sands underlie some 77,000 square kilometres, about 12% of the province. Alberta has three major oil sands deposits; the Athabasca deposit, the Cold Lake deposit and the Peace River deposit.

1. The Athabasca Deposit is the only area with surface mining and is the location of the renowned Suncor and Syncrude projects.

This deposit also has significant potential for in situ (drilling) production. That means the resource is too deep to mine, so it is extracted by drilling a well, then using techniques such as S.A.G.D. to allow the bitumen to flow through the well bore. However, for the Athabasca deposit, this type of development has only been for experimental or very small projects.

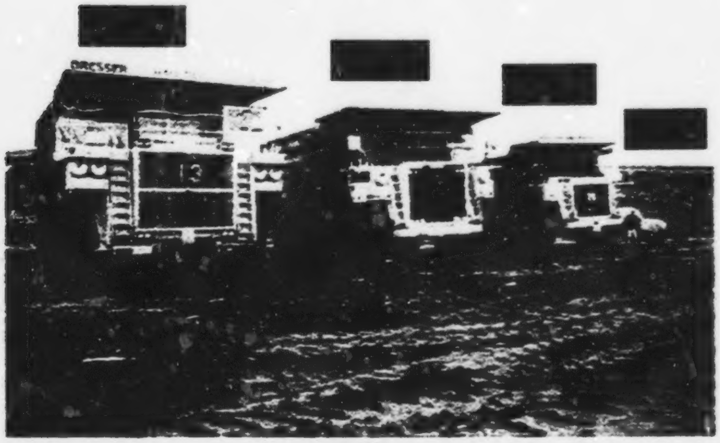
2. The Cold Lake deposit is a major in situ area with many projects, using both primary and thermal production technologies.

3. The Peace River deposit is also an in situ production area, but currently does not appear to have the same potential for extensive commercial development as the other deposits.

Current reserve estimates for Alberta are 1.7 trillion barrels of oil. With existing technologies the ultimate potential of recoverable oil is 300 billion barrels. Recent production has averaged 528,000 barrels a day.

Alberta
ALBERTA JAPAN OFFICE

Oil Mining is "Big" in Alberta


[redacted]
[redacted]
[redacted]
[redacted]

Since the 1970's there has been a huge change in the mining technology area. For example, Syncrude Canada Inc. has moved from using 85 ton trucks in the 1970's for overburden removal and oil sand ore transportation, to 240-ton heavy haulers in the 1980's. Syncrude is currently field testing 320-ton trucks made by Komatsu. Even larger sizes are currently under development by Komatsu and other manufacturers.

Oil Sands - Royalty Regimes

- Attractive 'Generic' Royalty Regime
- Applies to Mining and Drilling
- Reserve potential of billions of barrels
- About 20 leases 100% and about 20 leases 25% interest

In 1997, Alberta enacted a generic oil sands royalty regime that makes investment more attractive. The term "Generic" is used because it applies to all new oil sands investment projects whether surface mining or drilling technologies are used. The new regime simplifies administration and keeps our royalties competitive with other oil producing regions.

This change is of major benefit to Japanese investors. Japanese organizations hold a number of leases with rights to Alberta's oil sands with reserve potential in the billions of barrels. These organizations own approximately 20 leases and have a 25% interest in about 20 other.

Alberta
ALBERTA JAPAN OFFICE

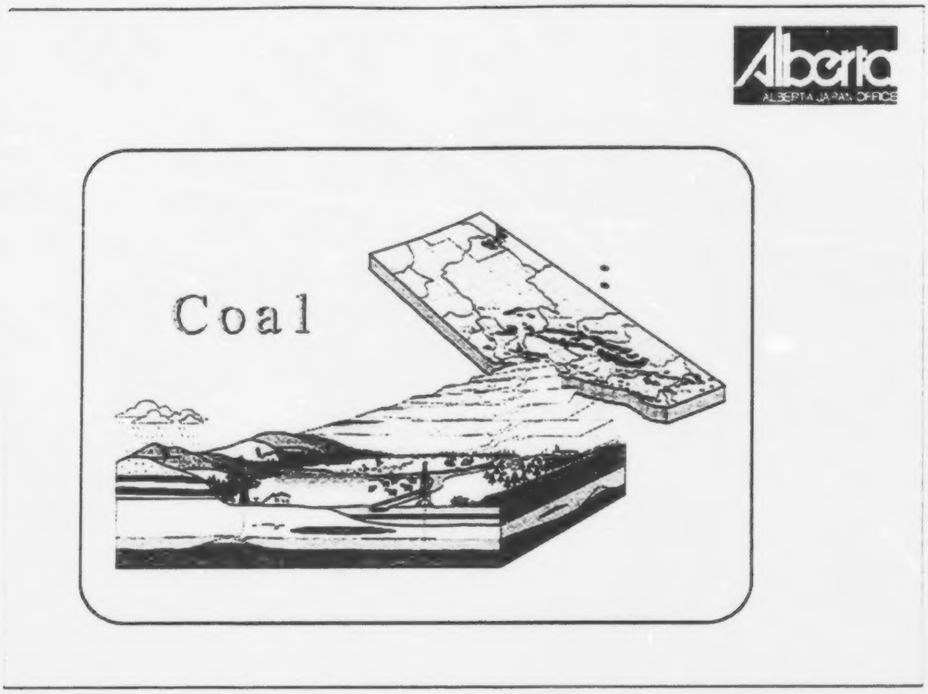
Oil Sands -
Continued Opportunities for Development

- S.C.O. Costs $13/bbl - 50% of 1970s Cost
- $24 Billion of New Investment
- Alberta and Japan Future

Technology advances have enhanced development opportunities. These advances have helped lower synthetic crude oil costs to $13 per barrel; half of the cost in the 1970's when major oil sands development began.

These advances, combined with Alberta's royalty regime, help keep the oil sands a competitive investment, even in today's low price environment. Industry has announced $24 billion of new investment for oil sands projects in Alberta over the next 10 years.

We welcome Japan's continued involvement in the development of our considerable oil sands resources. Alberta looks forward to Japan's participation in future oil sands projects and in the research and development of new technology.



Alberta
ALBERTA JAPAN OFFICE

Coal

About 70% of Canada's coal reserves are located in Alberta. Alberta's coal is distributed over three distinct areas of the Province: the Foothills regions, the Mountain region, and the Plains region.

1. The Foothills region tends to produce highly volatile bituminous (thermal) coals.
2. The Mountain region produces low to medium volatile bituminous (metallurgical) coals.

For ease of translation, I will refer to these types of coal as "coking coal".

3. In the Plains region the coal is sub-bituminous, which is lower in quality than coking coal. About 26 million tonnes is produced annually. This coal is solely used to generate most of Alberta's electricity. I will refer to it as electricity coal.

Alberta
ALBERTA JAPAN OFFICE

Coal - Development and Opportunities

- 7 Million Tonnes Coking Coal Produced
- Exported to Japan for Steel Making
- High Quality, Low Sulphur Content
- In 1996, Coal a Principal Exploration Target

Alberta produces over 7 million tonnes of coking coal annually, most of it exported. The Japanese steel making industry is a major client for this coal.

All Alberta coals are high quality with a very low sulphur content (between 0.2% and 0.7%). Alberta's coal reserves contain nearly twice the energy of all other Alberta non-renewable energy resources; that is oil, natural gas and oil sands.

In 1996, after oil and natural gas, coal was the principal exploration target. The Cheviot Coalmine Project by Luscar Ltd., was the largest in terms of exploration expenditures with an annual production capacity of 3.2 million tonnes.

Alberta
ALBERTA JAPAN OFFICE

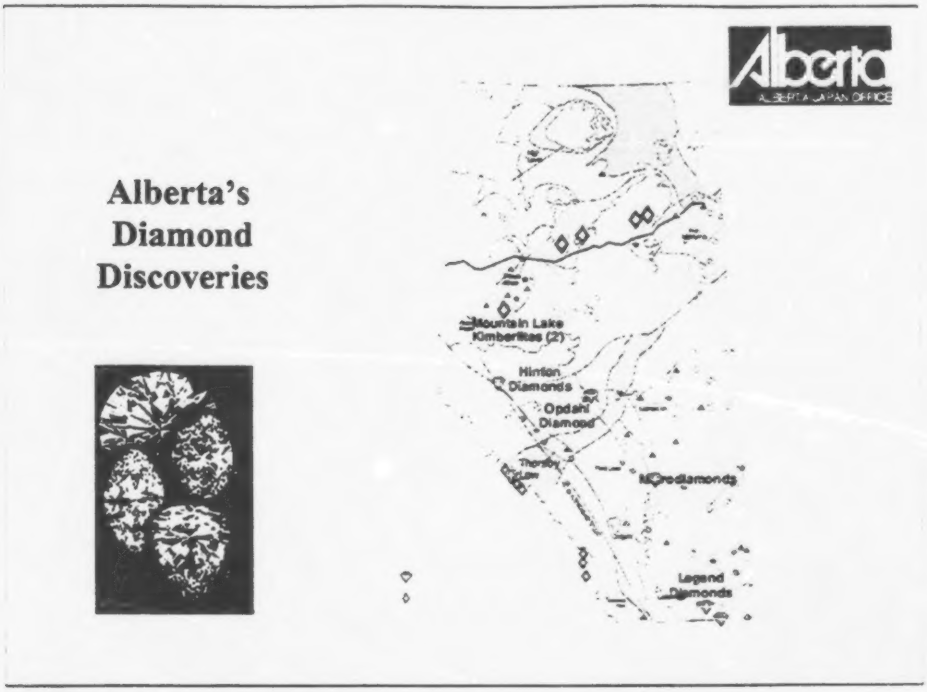
Coal - Royalty Regimes

- Royalty System Advantageous
- Subbituminous Coal Set at Flat Rate
- Bituminous Coal Recognises Recovery of Development Cost
- Substantial Reserves and Reliability of Supply

As with our oil sands royalties, Alberta's royalty systems for coal make the resource another attractive investment.

The royalty for electricity (subbituminous) coal is set at a simple flat rate. The royalty rates for coking (bituminous) coal are set at different levels before and after mine payout, to recognise the recovery of development costs.

Alberta has substantial reserves of coal and long-term reliability of supply to international customers. We have proven expertise in the area of mine productivity and continue to rely on Japan's involvement in Alberta's coal industry.



Alberta
ALBERTA JAPAN OFFICE

Alberta's Diamond Discoveries

Mountain Lake
Kimberlites (2)
Hinton
Diamonds
Opdahl
Diamond
Thorsby
Low
Microdiamonds
Legend
Diamonds

Oil sands and coal are not the only resource investment opportunities in Alberta. Although the province is relatively undeveloped in terms of its non-energy minerals, there is a lot of potential. For example, this geological map shows the many and varied diamond occurrences throughout Alberta.

Alberta
ALBERTA JAPAN OFFICE

Diamonds - A New Opportunity

- In 1997, Exploration Over 37 Million Hectares
- In 1998, Diamonds the Main Exploration Target
- 1997/98 23 Kimberlites Found in Buffalo Hills
- Potential Expenditures of $20 to $25 Million

And exploration for diamonds is booming in Alberta. In 1997, the Department of Energy received a record number of applications for permits covering an area over 37 million hectares. Diamond exploration continues to be the driving force in Alberta's mineral sector.

Numerous companies have evolved into partnerships and joint ventures in entering the diamond-related staking rush, including Ashton Mining of Canada, Pure Gold Minerals and the Alberta Energy Company. In the 1997/98 winter drilling season, 23 kimberlite pipes were discovered in the Buffalo Head Hills of northern Alberta.

One of the more promising pipes in this area produced 80 microdiamonds and 12 macrodiamonds. A clear, yellow diamond weighing 0.76 carats contributed to generating more excitement for exploring in Alberta. In 1998, exploration expenditures have the potential to reach $20 to $25 million. This new and exciting activity has our Alberta Geological Survey (AGS) continually updating the provinces' Diamond Map.

Non-Energy Minerals - Royalty Regimes

- Differences In Resource Development
- Recovery of Hard Rock Mining (Diamonds) Development Costs
- Placer Mining flat 5% of Production
- Quarriable Minerals Fixed Rate

Alberta's royalty regulations recognise the differences between developing different types of resources. Hard-rock royalties, like royalties for oil sands and coking coal, recognise the capital investment and risk necessary in developing an economic mine.

Other metallic and industrial mining regimes are designed to be simple for industry and easy to administer.

Alberta
ALBERTA JAPAN OFFICE

Alberta's Mining Potential

- Success of Neighboring Jurisdictions
- Advanced Information on Conventional Resources
- New Investment in Alberta's Advanced Geoscience

The pictures of diamonds shown in our presentation were only borrowed, but we hope we can show our own in the future.

Our neighbours in the Northwest Territories now have two economic mines with potential to produce a significant portion of the world's diamond supply. Saskatchewan and British Columbia have had a long history of mineral development and production.

The success of our neighbouring jurisdictions speaks highly to Alberta's potential for mineral discoveries and development. Considerable investment is being made in gathering, mapping and reporting information about Alberta's geology to develop an Advanced Geoscience Database.

Alberta
ALBERTA JAPAN OFFICE

Alberta Advantages

- Economic, Political, and Labour Stability
- Attractive to Invest
- Fiscally Responsible Government

Japanese investors in the mining sectors continue to enjoy the economic, political and labour stability of Alberta. Alberta is an attractive place to invest, do business and live because we have:

- One of the youngest, best-educated workforces in North America,
- First class transportation systems,
- User-friendly regulatory processes,
- Lowest overall tax levels in Canada, and
- A leaner, more efficient government committed to fiscal responsibility

Alberta
ALBERTA JAPAN OFFICE

Future for Japan and Alberta

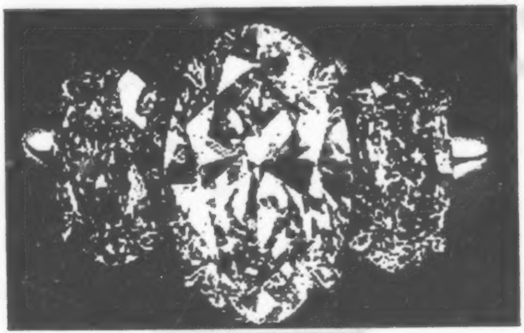
- Continuation of Relationship
- Exciting Potential and Investment Opportunities
- Alberta Energy and the 'Alberta Japan Office'

I would like to thank you for the opportunity to promote the benefits of Alberta. We invite you to experience the "Alberta Advantage" as Alberta wishes to continue its long and mutually beneficial relationship with Japan.

Take part in some of Alberta's tried and tested, as well as the new and exciting mineral development and investment opportunities.

Alberta's Department of Energy also invites you to use the information resources and ongoing support of the "Alberta Japan Office" to learn more about Alberta opportunities.

Alberta
ALBERTA JAPAN OFFICE



Environmental Stewardship and Mining

Mr. Robert Telewiak
Vice President, Environment
Falconbridge Limited

CANADA: A WINDOW ON GLOBAL MINING
World-Class Technology and Investment Prospects
Canadian Embassy, Tokyo, Japan
February 17, 1999

Mr. Robert Telewiak

Vice President,
Environment,
Falconbridge Limited

Robert Telewiak is Falconbridge's Director of Environmental Affairs. A key component of his responsibilities is promoting and facilitating the development of strategies and plans for effective, innovative and cost-effective improvements in environmental performance for Falconbridge's operations worldwide. He also leads and encourages environmental audits and other measures of self-regulation to ensure the company achieves or exceeds compliance with government guidelines and regulations and company policies.

Mr. Telewiak worked for Natural Resources Canada for a little over 20 years before joining Falconbridge in September 1996. In this capacity he held various positions in the department including Director of the Nonferrous Division which is responsible for departmental expertise on nickel, copper, zinc, lead, aluminum, gold, and several other metals. Environmental issues related to these metals were an important and growing part of his responsibilities.

On March 1, 1999 he will become Vice President of Environment. He will be responsible for developing and implementing corporate and operational policies and strategies in the areas of environment, occupational health, safety and industrial hygiene. He will ensure that Falconbridge's current business operations, new projects and exploration activities are conducted worldwide in compliance with company policy and government guidelines and regulations.

His educational background includes degrees in geology and economics.

Environmental Stewardship and Mining

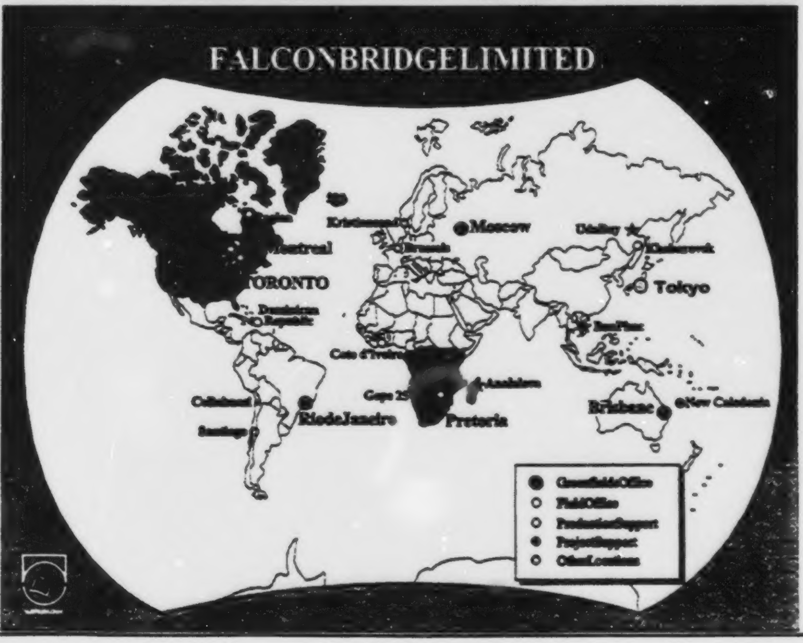
Robert Telewiak
Falconbridge Limited
February 17, 1999

Outline of Presentation

1. A few facts on Falconbridge
2. Approach to environmental issues
3. Operational issues
4. Sustainable development
5. Conclusions

A Few Facts on Falconbridge

- an integrated producer of base metals, annual sales of over $2 billion
- world's third largest producer of nickel, a leading producer of copper
- other products include zinc, cobalt, PGM's, silver, gold, sulphuric acid, and assorted minor metals
- 6700 employees
- 50% owned by Noranda
- production facilities are in Sudbury and Timmins in Ontario, Ungava district of northern Quebec, Dominican Republic, Norway, Chile



FALCONBRIDGELIMITED

Kristiansand
Moscow
Montreal
Brussels
TORONTO
Tokyo
Dominican Republic
Cote d'Ivoire
RiodeJaneiro
Pretoria
Santiago
Brisbane
New Caledonia
● GreenfieldsOffice
○ FieldOffice
○ ProductionSupport
● ProjectSupport
○ OtherLocations

Environmental Protection Has Become an Integral Part of Everyday Business

- approach is based upon the recognition that Falconbridge operates at the consent of society
- environment considerations apply to all phases: exploration, mining, processing, use and recycling
- pollution prevention principles have been incorporated into the planning process

Why the Emphasis on Enhancement of Environmental Performance

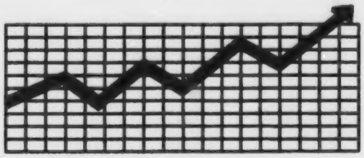
- governments, ENGO's, public, employees, shareholders and other stakeholders all want enhanced performance
- desire to be ahead of the environmental agenda
- environment has become one of our corporate values
- shareholder value is created

General approach includes:

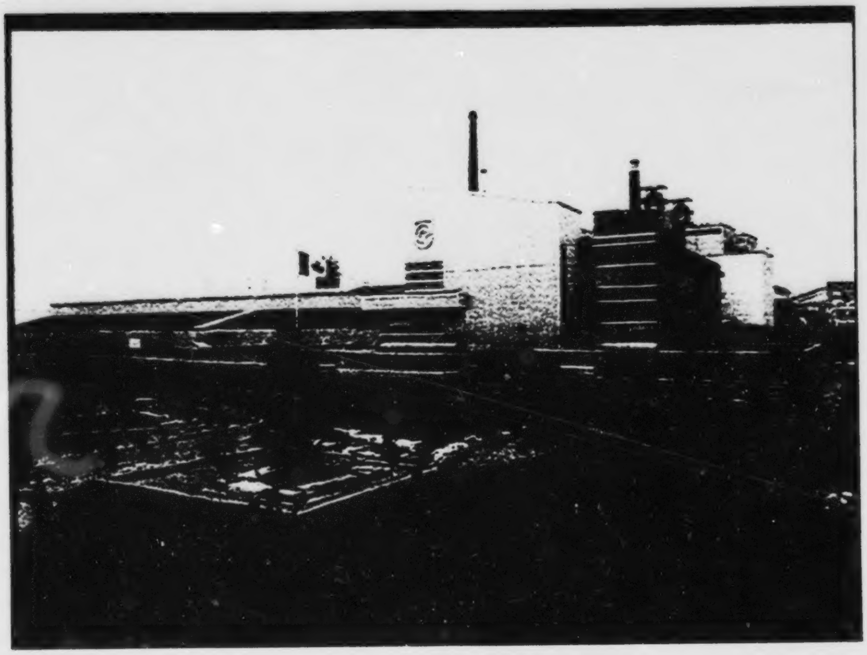
- continuous improvement
- risk management
- ISO 14001
- setting and achieving targets
- public reporting
- audit program
- research
- product stewardship
- working with all stakeholders

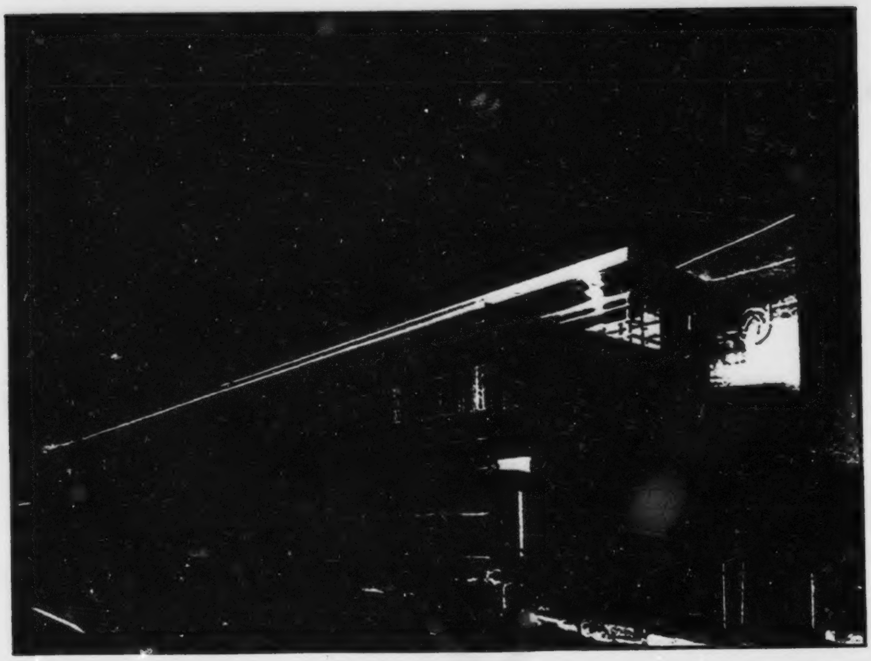
Environmental Performance of Falconbridge

- environmental performance in all operations has been generally improving for many years



- current challenge is to continue progress while reducing production costs

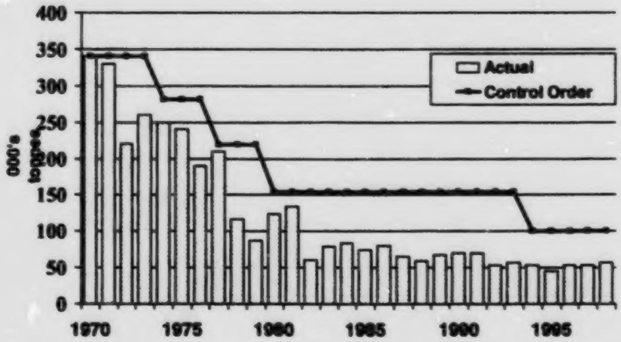




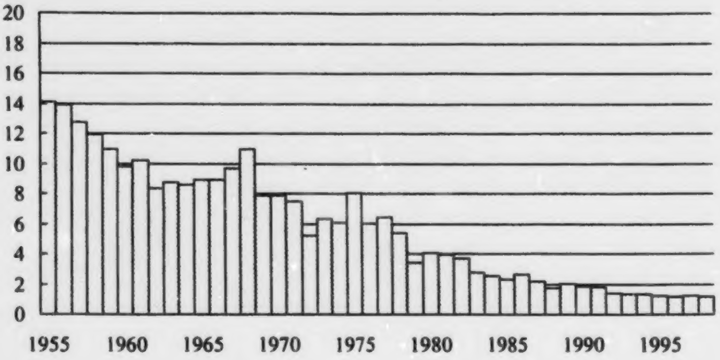
The Sudbury Challenge

- decrease emissions while increasing nickel production by **50%** and reducing cash costs to $1.30/lb of Ni
- response
  - 5 year $150 million modernization program will achieve production and environmental objectives
  - **78%** decline in emissions of ARET substances from 1988 - 2000

Sudbury Emissions of Sulphur Dioxide



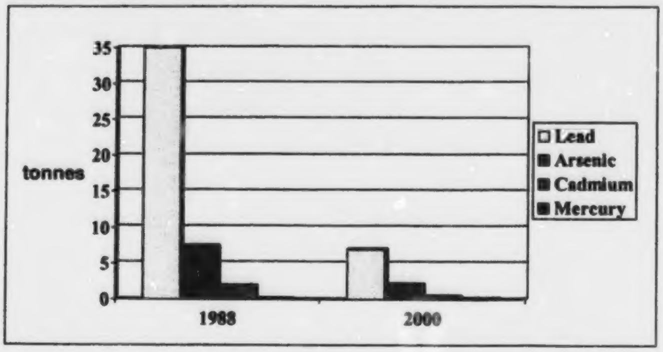
Ratio of SO_2 Emitted to Nickel Produced at Sudbury



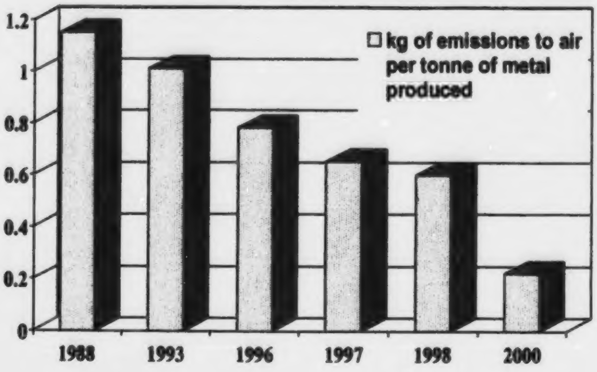
Water is Treated as a Resource

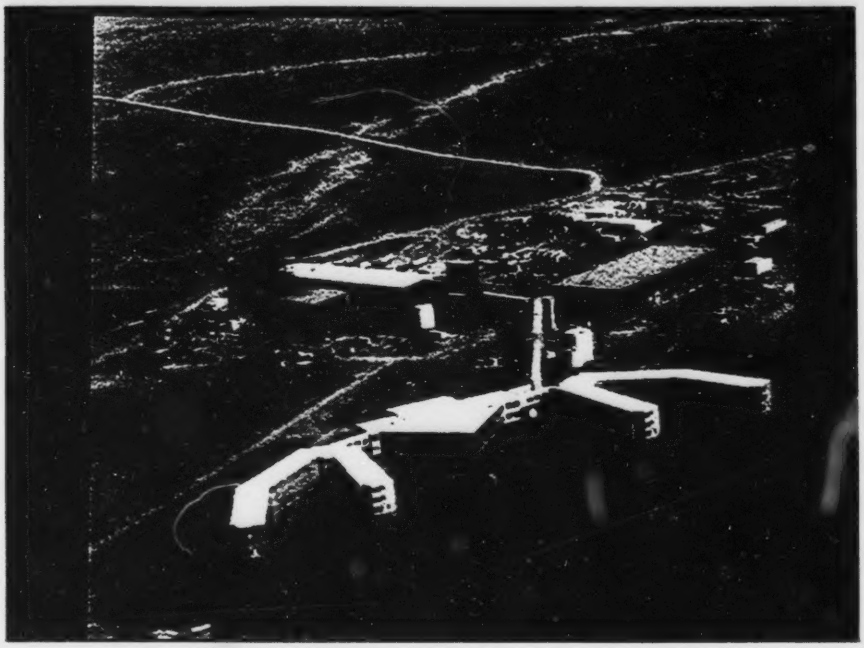
- after initial use the water is treated and re-used with the remainder discharged to the environment
- at Sudbury, since toxicity testing of effluent discharges began in 1991 all samples have passed
- testing now required by government every 3 months as opposed to monthly
- mill effluent is 1/10 the regulatory limit of 0.5mg/l and at the smelter it is 1/3 the limit

Kidd Metallugical Division Emissions



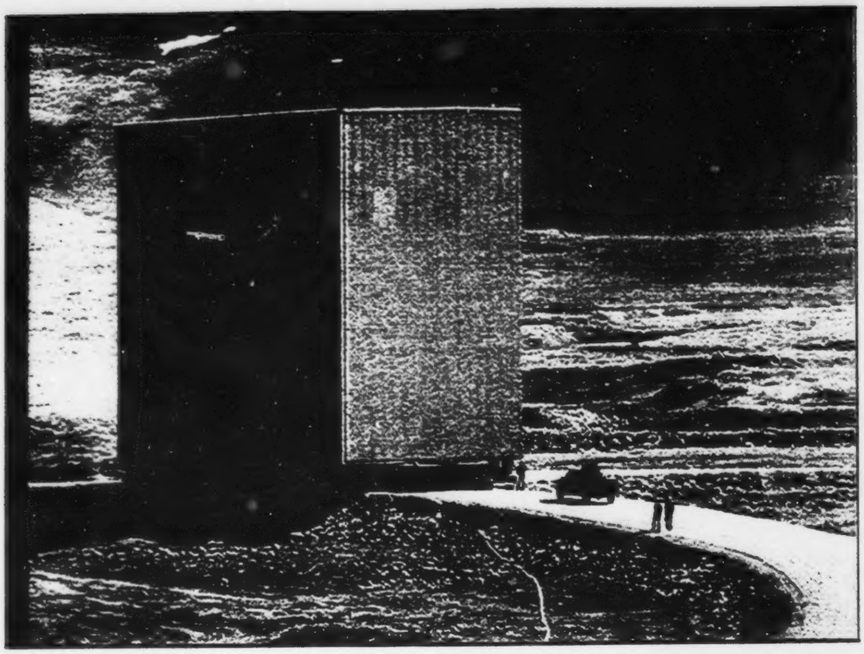
Falconbridge Kidd - ARET Emissions Versus Production

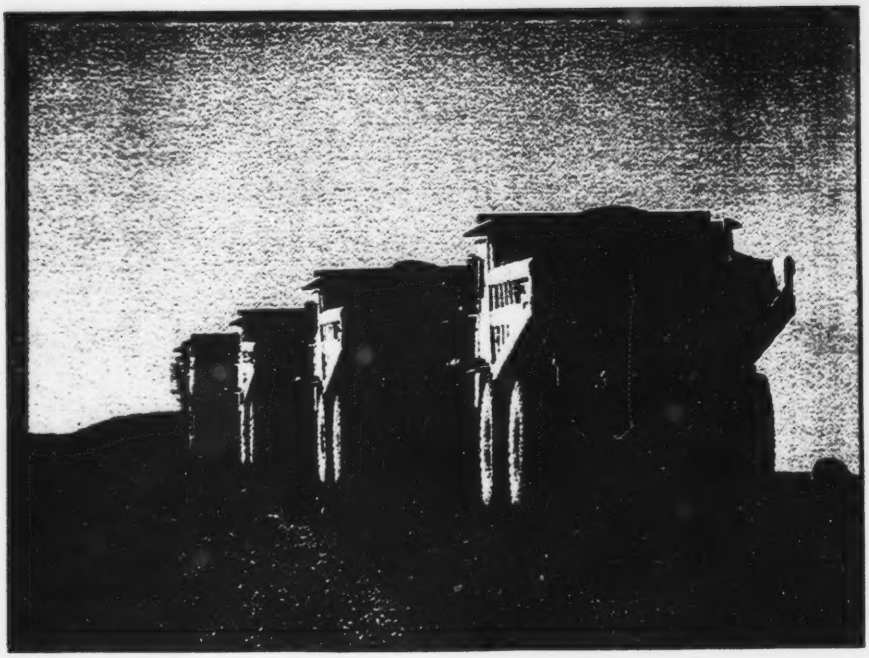


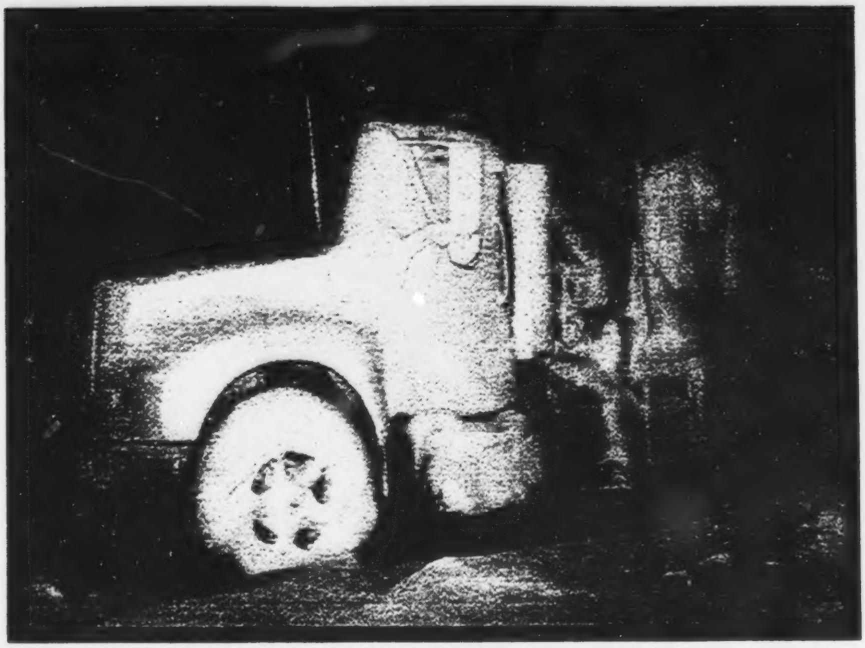


Raglan

- 20,000tpy nickel mine in northern Quebec, 1400 km north of Montreal
- advanced exploration in late 1980's, extensive discussions with Inuit in early 1990's, an agreement signed with Inuit in 1995, and commercial production in third quarter 1998







Raglan Agreement with Makivik

- 1995 agreement:
  - addresses environmental concerns
  - gives priority to hiring and training Inuit
  - provides contracting opportunities for Inuit enterprises
  - provides guaranteed payments and profit sharing representing more than $60 million over 18 years
- to protect the migratory pattern of animals and to minimize disruption of Inuit hunting, there are no shipments of concentrate between mid-March to mid-June

Ongoing Communication

- Committee consisting of Makivik Corp., local villages and Falconbridge established
- meets 2 to 3 times per year
- discuss various issues including training and the environment
- an external consultant will analyse and make recommendations to the committee on any outstanding environmental issues

Environment Protection Designed into Project

- baseline studies on all aspects of regional environment including climate, archaeology, landuse patterns, and land and sea life

- based on these studies, rigorous design criteria incorporated into project

Workforce at Raglan

- currently over 20% of the workforce are Inuit
- objective is to increase this percentage
- training being pursued
- increased flexibility in work scheduling is being examined

Inuit Training and Employment

- Falconbridge employs as many local people as possible; eg. in Dominican Republic, of 1500 employees only one Canadian

- in consultation with the Inuit regional government, School Board and Inuit employees, Falconbridge has initiated an active Raglan training program

Award from Quebec First Peoples Business Association

Falconbridge recently awarded the Association's Grand Prize for:

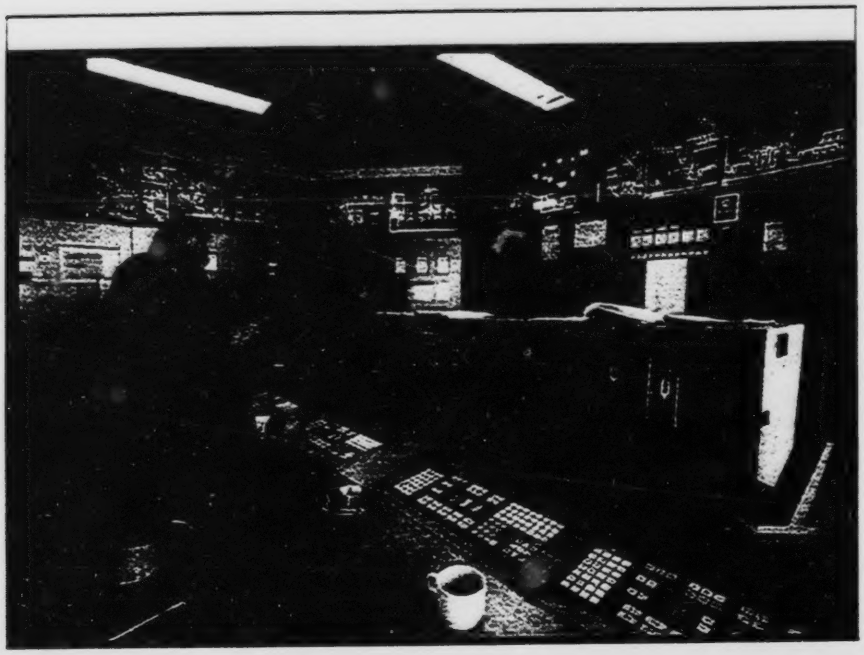
- efforts in native employment;
- support of aboriginal businesses; and
- development of the Raglan Agreement.

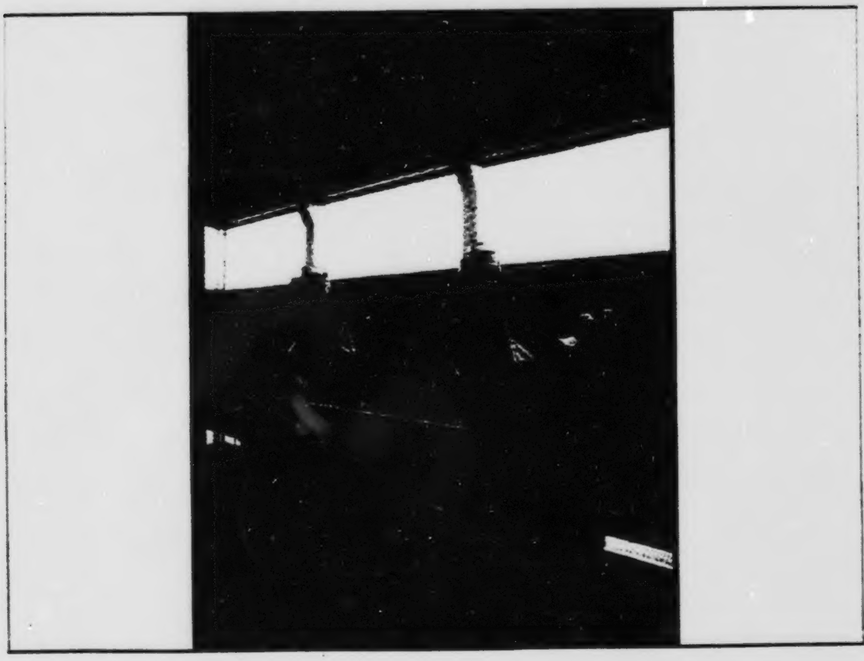
"The official opening of the mine marks a milestone in which a development such as this is going ahead based on a negotiated agreement and relationship between us as Aboriginal people, and the developers. It has evolved into an example of how a relationship which benefits both sides can be thrashed out, and I know that it is being looked upon as a model of how such things can be run well".

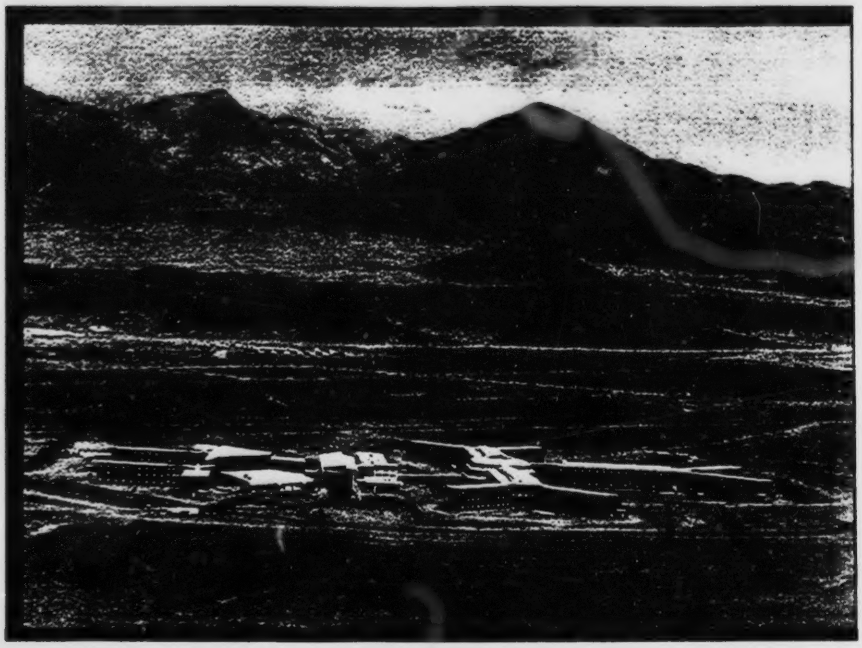
Zebedee Nungak
President, Makivik Corporation
Official Opening, July 15, 1998

Falcondo

- ferro-nickel operation in Dominican Republic
- production started in 1972
- mine, smelter and associated oil refinery and power plant

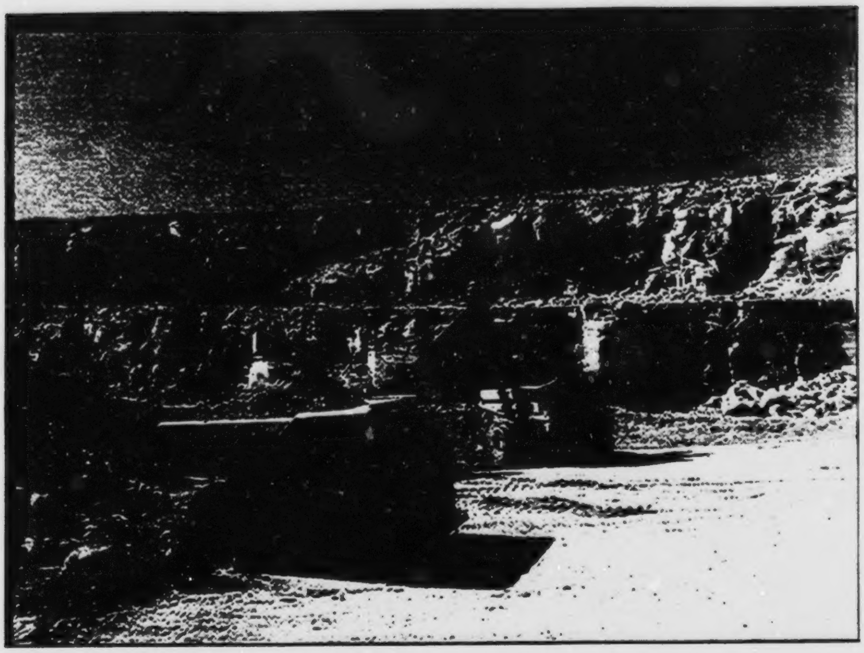


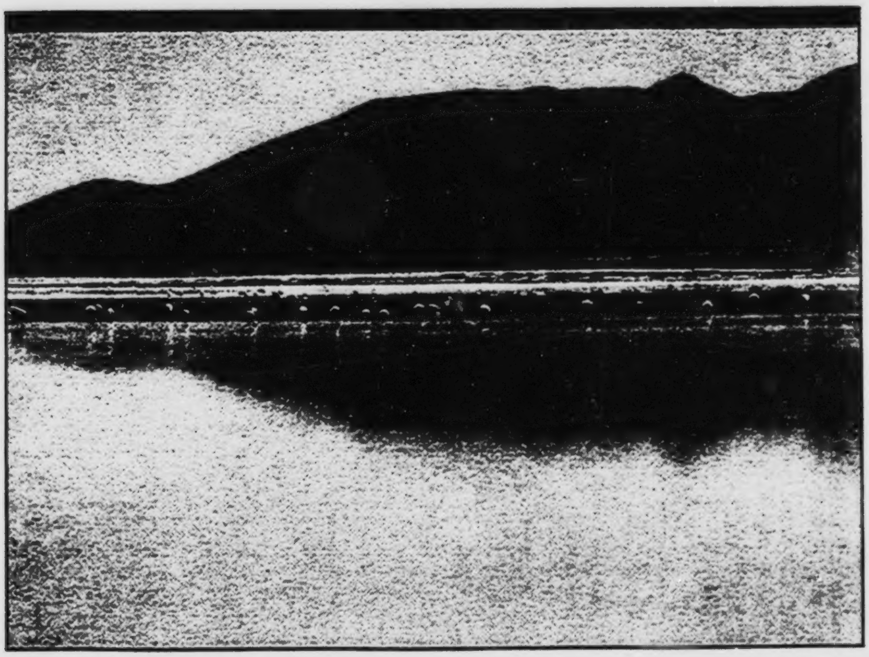




Collahuasi

- $2.1 billion copper mine development in Chile
- Ownership:
  - 44% Falconbridge
  - 44% Minorco
  - 12% Japanese consortium
- 400,000tpy of Cu, reserves for 100 years
- commercial production started in Jan. 1999





Sustainable Development Policy

Sustainable development is the implementation of practices and policies that contribute to the well-being of the environment, economy and society to address the needs of customers, suppliers, shareholders, employees, governments, the general public and the communities in which we operate, without compromising the ability of future generations to meet their own needs.

Principles

- improve scientific knowledge and technologies
- promote responsible standards
- promote safe use and recycling of our products
- facilitate dialogue with stakeholders
- foster the well being of local communities
- promote employee awareness of this policy
- regularly communicate progress to stakeholders

Conclusions

- we our proud of our accomplishments but there is much more to be done
- we operate at the consent of society and conduct our business around the world in accordance with that principle, and
- we are committed to implementing the principles of sustainable development in order to continue to build long term shareholder value

Research and Development at Inco Limited

Dr. Wm. Gordon Bacon
Vice President, Technology and Engineering
Inco Limited

CANADA: A WINDOW ON GLOBAL MINING
World-Class Technology and Investment Prospects
Canadian Embassy, Tokyo, Japan
February 17, 1999

Dr. Wm Gordon Bacon, P.eng.

Vice President, Technology And Engineering
Inco Limited

Gord Bacon graduated with a B.A. Sc. in Mineral Processing Engineering and a Ph.D. in Metallurgical Engineering, both from UBC in British Columbia in Canada.

His early career was in the potash and copper industries with IMC Corp and Kennecott respectively. He then founded Bacon Donaldson and Associates Ltd. a Vancouver, B.C. Canada based consulting metallurgical firm providing physical and extractive metallurgical services to the resource industries. He was president and senior partner for twenty-one years.

Gord then joined Sherritt Gordon Mines as Research Director and then became Vice President for Sherritt International. Then Gord became Vice President of Primary Metals Technology, then added Engineering to become Vice President of Technology and Engineering for Inco.

Gord Bacon

Vice President
Technology & Engineering
Inco Limited

Research & Development at Inco Limited

Research & Development

- ❐ Process research
- ❐ Product research

Process Research Objectives

1. Reduce the costs of metal production
    - ❐ Process improvements
    - ❐ New business opportunities
    - ❐ Assistance to processing plants

Process Research Objectives

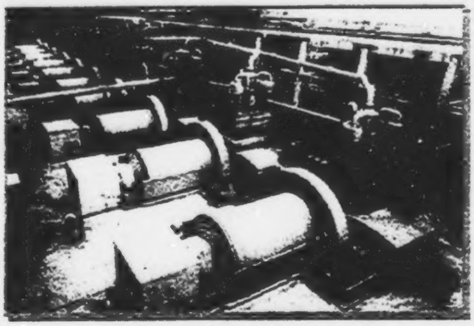
2. Develop low cost processes for recovery of nickel and byproducts from new orebodies

Process Research Objectives

1. Reduce the costs of metal production
2. Develop low cost processes for recovery of nickel and byproducts from new orebodies
3. Minimize environmental impact

Milling Operations

Ontario Division



- ☐ Targeting 2% increase in nickel recoveries from Clarabelle Mill
- ☐ Revenue increase $7 million/year

Milling Operations

Manitoba Division

- ☐ Increased grade of concentrate

  Reduce smelting costs by $2 million/year
- ☐ Developing new processes for treating difficult ores

Smelting & Refining Operations

Ontario Division

- ☐ Increased throughput by improving smelter availability
- ☐ Optimal choice of refractories suited for high temperature operations

Smelting & Refining Operations

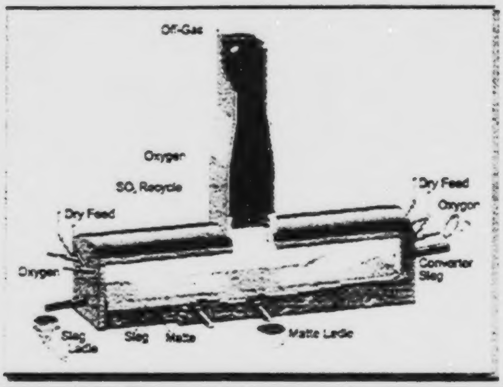
Manitoba Division

- ☐ Reducing smelting costs
- ☐ Developed new process for copper treatment
  - ☐ Reduce operating costs $3.5 million/year

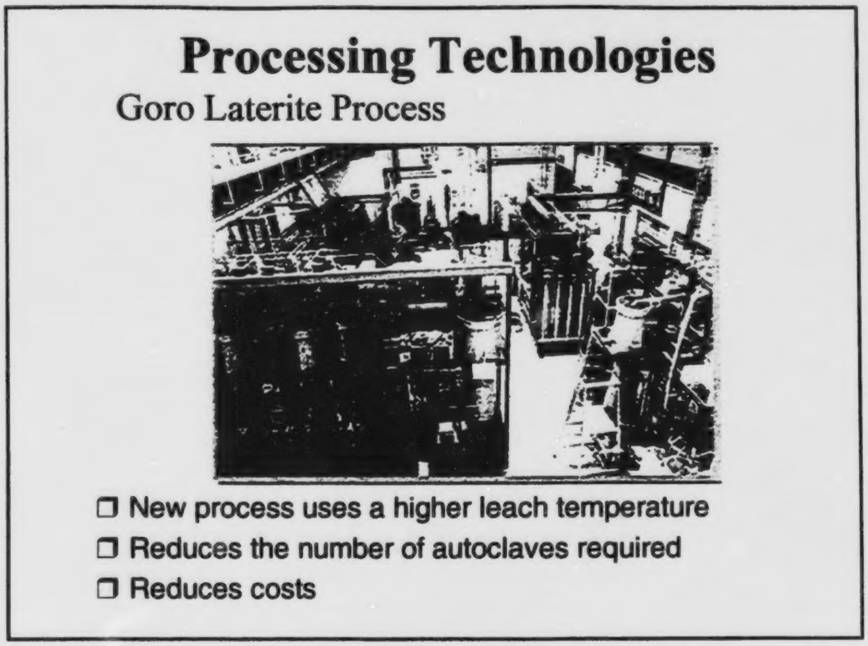
Smelting & Refining Operations

Ontario Division

- Increasing throughput of pellet decomposer by developing a new heat exchanger


Off-Gas
Oxygen
SO$_2$ Recycle
Dry Feed
Dry Feed
Oxygen
Oxygen
Converter Slag
Slag Ladle
Slag
Matte
Matte Ladle

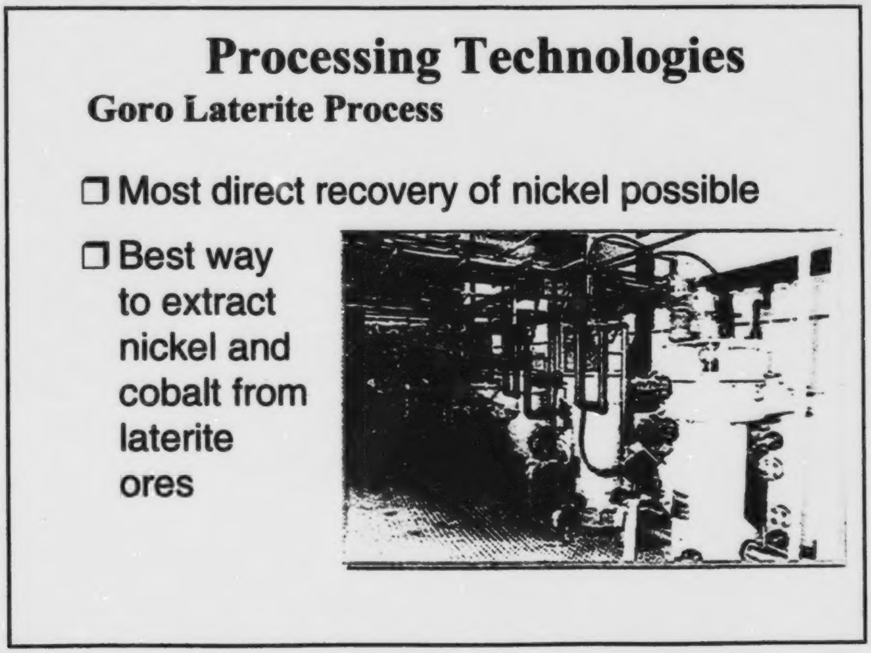
Developing low cost process technologies for new ore



Processing Technologies

Goro Laterite Process

- New process uses a higher leach temperature
- Reduces the number of autoclaves required
- Reduces costs



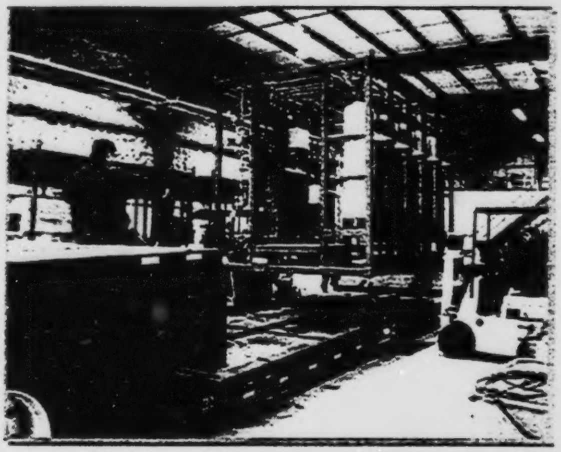
Processing Technologies

Goro Laterite Process

- Most direct recovery of nickel possible
- Best way to extract nickel and cobalt from laterite ores

Processing Technologies

Goro Laterite Process



Cyanide Destruction

Cyanide Destruction

Inco SO_2 / Air Process Licensees

Canada

1. Ketza
2. Mt. Sukum
3. Skyline
4. Golden Bear
5. Westmin
6. Scottie
7. Dupont of Can. Exp.
8. Sable
9. Equity
10. Nickel Plate
11. Carolin
12. Lynngold
13. Campbell
14. St. Andrew
15. Citadel
16. ERG
17. McBean
18. Kerr Mill
19. Kuntz
20. Precious Plate
21. Superfinish
22. IBM
23. Kiena
24. Bousquet
25. Casa Berardi
26. Lac Shortt
27. Mauntoban
28. Hope Brook
29. Detour
30. Quesnel River
31. Dome
32. Sigma
33. Trollus
34. Bisset
35. Mt. Nanson
36. Nugget Pond
37. Musselwhite
38. Doyon

Cyanide Destruction

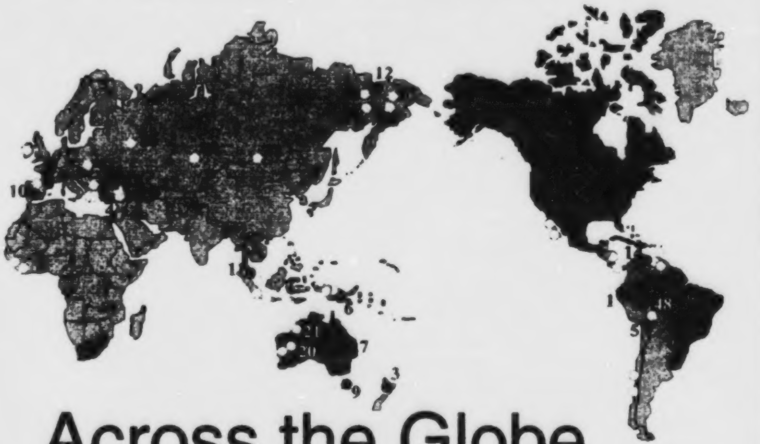
Inco SO_2 / Air Process Licensees

United States of America

1. Grant
2. Ryan Lode
3. Kettle River
4. Mineral Hill
5. McCoy/Cove
6. Hayden Hill
7. Snowcaps
8. Colosseum
9. Mercur
10. San Luis
11. McLaughlin
12. Bullfrog
13. Fort Knox
14. Golden Sunlight
15. Round Mountain
16. Midas

Cyanide Destruction

Inco SO_2 / Air Process Licensees



Across the Globe

Cyanide Destruction

Inco SO_2 / Air Process Licensees

☐ Active International Know-How Licenses

1. Yanacocha - Peru
2. Cienega - Mexico
3. Macraes - New Zealand
4. Dikili - Turkey
5. Kori Kollo - Bolivia
6. Tolukuma - Papua
7. Gympie - Australia
8. Salsigne - France
9. Henty - Tasmania
10. El Valle - Spain
11. Penjom - Malaysia
12. Kubaka - Russia
13. Kumtor - Kyrgystan
14. Las Cristinas - Venezuela
15. Bronzewing - Australia
16. Mt. Muro - Indonesia
17. Santa Rosa - Panama

Cyanide Destruction

Inco SO_2 / Air Process Licensees

❒ International Clients Test Work & Engineering Completed

18. Tuprag - Turkey
19. Omagh - Ireland
20. Maude Creek - Australia
21. Wiluna - Australia
22. Selinsing - Malaysia
23. Morobe - Papua
24. Toka Tindung - Indonesia
25. Gosowong - Indonesia
26. Baley - Russia
27. Lunoe - Russia
28. Julietta - Russia
29. Asacha - Russia
30. Kuranakh - Russia
31. Sukhoi-Log - Russia
32. Canatuan - Philipines
33. Sansu - Ghana
34. Paredonas - Mexico
35. San Felipe - Mexico
36. Lobo Marte - Chile
37. Pascua - Chile
38. Beaconsfield - Tasmania
39. Almagrera - Spain
40. Tomi - Venezuela
41. Kaperske - Slovakia
42. Olympias - Greece
43. Cerateppe - Turkey
44. Dukat - Russia
45. Brisas - Venezuela
46. Thracean - Greece
47. Tarkwa - Ghana
48. Don Mario - Bolivia
49. Cerro Mojon - Nicaragua
50. Porgera - Papua
51. Tuvatu - Fiji
52. Kyprou - Greece

Cyanide Destruction

The Chemistry

Oxidation

$$CN^-_{FREE} + SO_2 + O_2 + H_2O \rightarrow OCN^- + H_2SO_4$$

$$Me(CN)_4^{2-} + 4SO_2 + 4O_2 + 4H_2O \rightarrow 4OCN^- + 4H_2SO_4 + Me^{2+}$$

$$Me^{2+} = Zn^{2+}, Cu^{2+}, Ni^{2+}, Cd^{2+}, etc....$$

Neutralization

$$H_2SO_4 + Ca(OH)_2 \rightarrow CaSO_4 \bullet 2H_2O$$

Precipitation

$$Me^{2+} + Ca(OH)_2 \leftrightarrow \underline{Me(OH)_2}\downarrow + Ca^{2+}$$

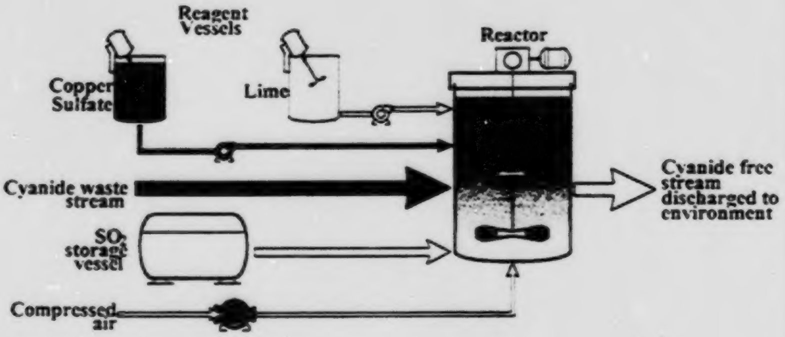
$$2Me^{2+} + Fe(CN)_6^{4-} \leftrightarrow \underline{Me_2Fe(CN)_6}\downarrow$$

Reactions Catalyzed by Copper in Solution

$$\frac{SO_2}{CN_{WAD}} = 2.46 g/g$$

Cyanide Destruction

The Inco SO2/Air Process


Reagent Vessels
Copper Sulfate
Lime
Reactor
Cyanide waste stream
SO_2 storage vessel
Compressed air
Cyanide free stream discharged to environment

Cyanide Destruction

Other Applications

☐ Plating shops

☐ Ferro-ferri cyanide waste streams *(electronic, photographic industries)*

☐ Flotation waste slurries

☐ Coke oven and blast furnace scrubber effluents

☐ Aluminum pot effluents

☐ Oxidation of thiocyanate *(SCN)*

☐ Oxidation of thiosalts *(*S_2O_3, S_3O_6, S_4O_6*, etc…)*

☐ Oxidation of arsenic, manganese, iron, etc...

Summary

- R&D finding new ways to lower operating costs
- Developing new low cost process technologies
- Leading in development of new value-added uses for nickel and nickel derivatives

Advanced Mining at Inco Limited

Dr. Greg Baiden
Manager, Mines Research
Inco Limited

CANADA: A WINDOW ON GLOBAL MINING
World-Class Technology and Investment Prospects
Canadian Embassy, Tokyo, Japan
February 17, 1999

Dr. Greg Baiden

Mines Research
Inco Limited

Dr. Greg Baiden is currently Manager of Mines Research at Inco Limited. This job includes, corporate mining research for Inco and diamond drilling, raise boring and equipment acquisitions for the Ontario Division. The research component of the job entails mining methods, mining engineering and equipment automation.

Dr. Baiden holds a Ph.D. in Underground Mine Automation from McGill University (1993); a Masters of Science from Queens University (1986); a Bachelor of Science from Queens University (1984); and Civil Engineering from Ryerson Polytechnical Institute (1981).

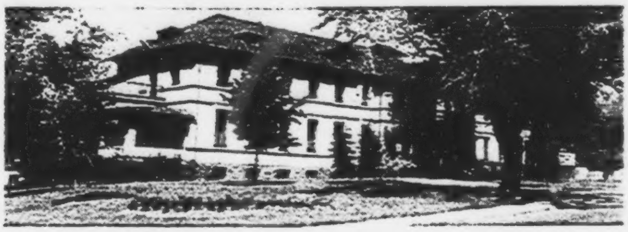
Greg Baiden

Manager
Mines Research
Inco Limited

February, 1999

Advanced Mining at Inco Limited

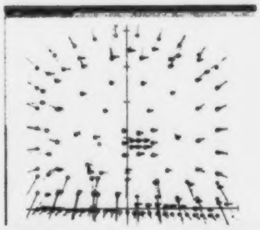
Mission

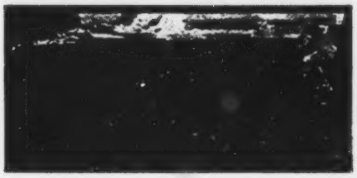


- ☐ Develop the techniques to:
  - ☐ Increase mine value
  - ☐ Improve mining costs

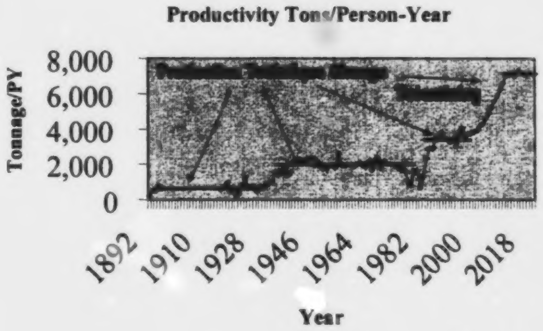
Mining Research Objectives

- ☐ Mining process research
- ☐ Telemining^{tm} research
- ☐ Mine planning and simulation research





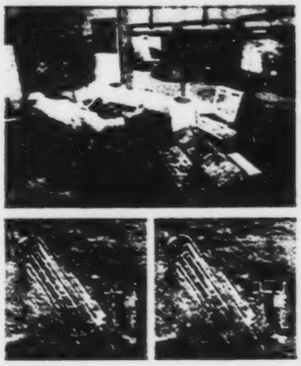
Historic and Projected Productivity Improvements



* Telemining will become our future production technique

Teleminingtm Our next step!

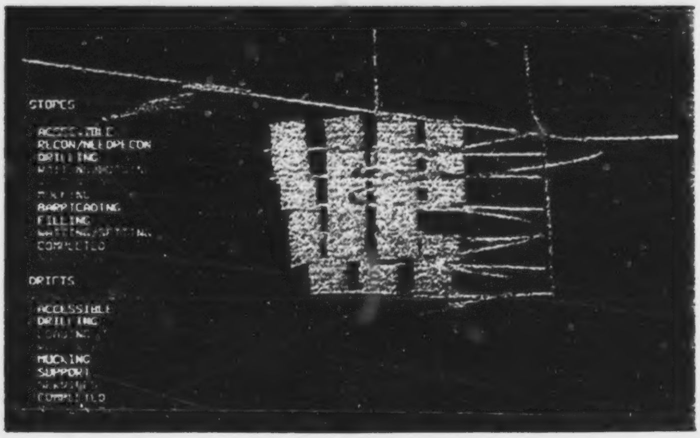
- ❒ Long distance remote control of all our mining equipment means:
  - ❒ Operations Software
  - ❒ Control Room
  - ❒ Telecommunication
  - ❒ Mining Machinery
- ❒ Telemining will allow us to:
  - ❒ speed up the rate of mining
  - ❒ reduce our costs
  - ❒ improve our quality



Research Mine Geology and Planning

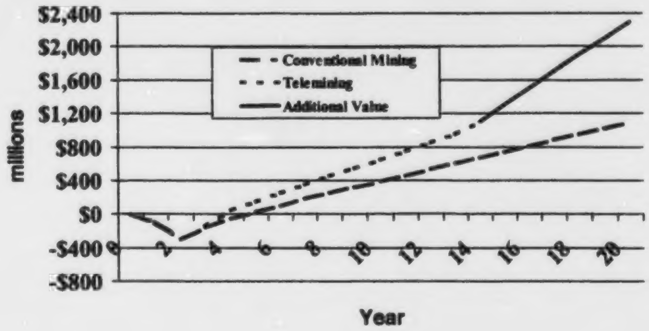
Ontario Division

Research Mine Simulator


STOPES
ACCESSIBLE
RECON/NEEDRECON
DRILLING
BARRICADING
FILLING
COMPLETED
DRIFTS
ACCESSIBLE
DRILLING
MUCKING
SUPPORT
COMPLETED

Telemining Benefits

Typical mining property cash flow

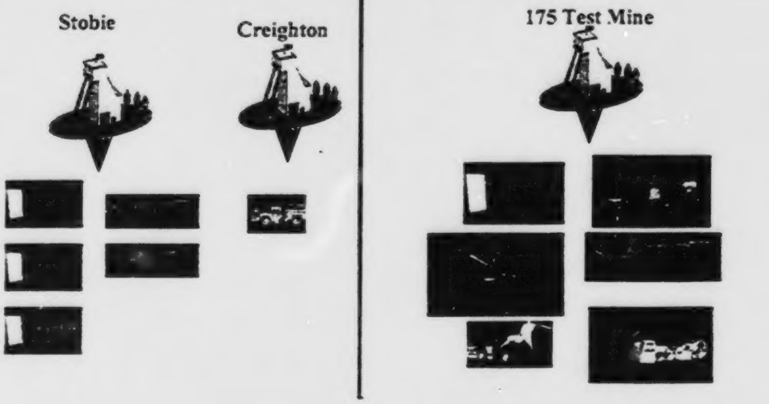


Individual Machine Benefits

- ❒ Safety
  - ❒ less time underground
- ❒ Productivity
  - ❒ Currently 1 person/machine
  - ❒ Telemining has already demonstrated - 1 person/3 machines
- ❒ Value added time
  - ❒ Currently up to 15 hours/day
  - ❒ Telemining has already demonstrated 23 hours/day
- ❒ Cycle Time
  - ❒ Faster drilling and mucking

Multiple Minesites using Telemining Situation Today

Drills and LHDs in use | Equipment under development



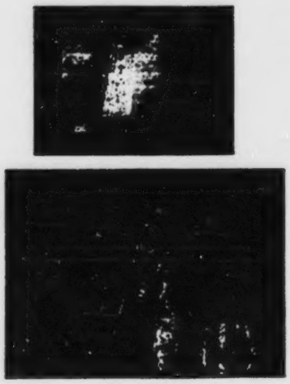
Stobie

Creighton

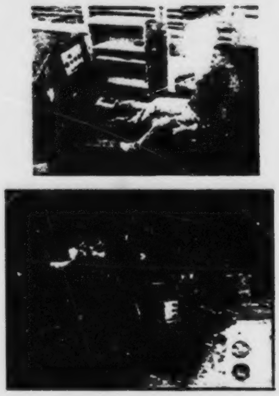
175 Test Mine

•What is working in production now? Teledrilling using Data Solo Drills

- ❒ Benefits
  - ❒ Reduction in working capital
  - ❒ Reduction in operating and maintenance labour
  - ❒ Improved logistics
- ❒ ***3 drills with 1 operator*** and a rover can do more work than ***5 drills and 5 operators***



•What is working in production now?
Telemucking

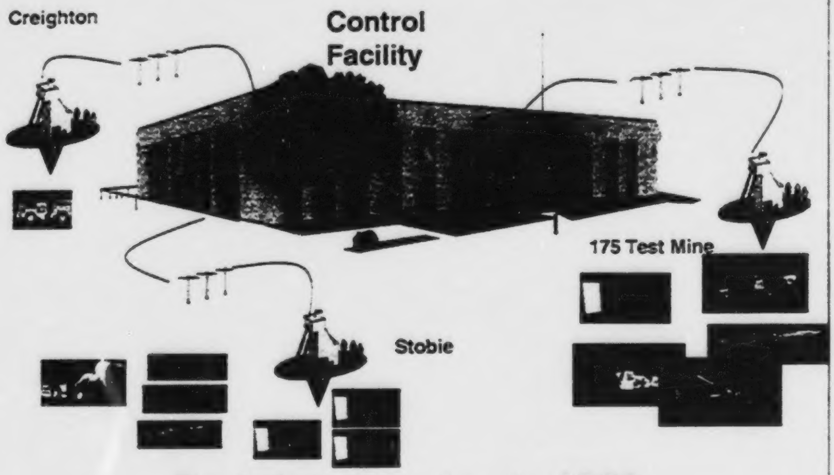


- Benefits
  - Operator and machine utilization
  - Reduced working capital
  - Reduction in operating and maintenance labour
  - Improved logistics
- ***2 LHDs with 1 operator*** has the potential to exceed the work of 2 LHDs and 2 ***operators***
- ***Single LHD operation has demonstrated 23 hours of operation in a day***

•What are the systems being developed?
Teleremote Mining Technologies

- Jumbo Drills and Explosives Loaders with microprocessor-based Detonators
- Benefits
  - Faster development
  - Improved mine cash flow
  - Reduced direct and indirect cost

Mine Operations Centre to Multiple Minesites


Creighton
Control Facility
175 Test Mine
Stobie

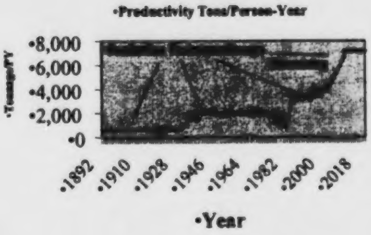
Prototype running in 1999

Estimated Financial Impact of Telemining from a Mine Operation Centre

Measure	Conventional mining Technology	Telemining from a Mining Operation Centre
IRR	-24%	130%
$US/Tonne	$50	$20
$US/tonne of Annual Capacity	$300	$100

•Summary

- ☐ The benefits of Telemining shift the mine economics considerably
- ☐ Three drills and three LHDs are now at work Telemining
- ☐ A prototype Central Mining Operation Facility will be up and running in 1999



Mines Research

INCO

Mine Automation and Uranium Mining

W. L. (Bill) Murphy
Director, Marketing - Asia & Canada
Cameco Corporation

CANADA: A WINDOW ON GLOBAL MINING
World-Class Technology and Investment Prospects
Canadian Embassy, Tokyo, Japan
February 17, 1999

W. L. (Bill) Murphy

Director,
Marketing Asia & Canada,
Cameco Corporation

Bill graduated from the University of New Brunswick in 1972 with a Bachelor of Science degree in Geology. He worked on various base metal and uranium exploration projects in the Atlantic Provinces of Canada until 1978, when he and his family moved to Northern Saskatchewan to begin his work with SMDC (Saskatchewan Mining Development Corporation).

Bill operated several uranium exploration projects for SMDC in and around the Athabasca Basin of Saskatchewan. In 1981, he began a gold exploration program in Northern Saskatchewan which led to the discovery of SMDC's first gold mine - Star Lake.

Bill continued to oversee uranium and gold exploration projects for SMDC until 1987 when he became Manager of Northern Affairs. In this role his responsibility was to strengthen the Company's relationship with the small communities in Northern Saskatchewan, where the Company's major uranium mining operations are located.

In 1988, SMDC and Eldorado Nuclear were merged to create Cameco Corporation, and Bill began his Marketing career with Cameco in 1989. Since that time he has been responsible for Cameco's Marketing and Sales in Europe, South America, and is currently Director of Marketing for Asia & Canada.

Bill and his wife, Colleen, live in Saskatoon with their two Golden Retrievers.

Mine Automation and Uranium Mining

Slide 1: Presentation Title
MINA-SAN, OHAYO GOZAIMASS
Good morning Ladies and Gentlemen.

Slide 2: Content
Today I would like to:

(1) give you an overview of
    CAMECO
    The Cigar Lake Project; and
    The McArthur River Project

followed by

(2) the reasons for automation at these mines.

(3) I will then describe the mine development and ore extraction methods at Cigar Lake and McArthur River

(4) and the ore processing and handling systems common to both.

Slide 3: Company Logo
Some of you may already be familiar with Cameco, so I ask for your patience while I present a brief overview of our company for those who are not acquainted with us.

Slide 4: World's largest...
In 1988, two major Canadian uranium companies merged to form Cameco Corporation which is now the world's largest uranium producer. Our head office is in Saskatoon, Saskatchewan, Canada.

We have mining operations in Canada, the United States and the central Asian Republic of Kyrgystan.

We currently have about 1400 employees in North America. Including our subsidiaries and our long-term contractors, our people number some 3500.

Cameco has about 57 million shares outstanding and is traded on the Toronto, Montreal and New York stock exchanges. About 9% of the shares are held by the province of Saskatchewan. The remainder are widely held, primarily by institutional investors including pension fund companies.

Slide 5: 40% of Western World Uranium ...
Cameco's main business is the production and sale of uranium concentrates and uranium conversion services. Through our subsidiary, Cameco gold, we also produce nearly 650,000 ounces of gold per year.

Cameco produces about 40% of the total uranium produced in the western world. We supply about 20% of the western world's requirements for the conversion of uranium concentrates to uranium hexaflouride.

In addition, we are the only commercial-scale supplier of natural uranium dioxide for Candu nuclear fuel.

Cameco's share of uranium reserves and resources would be enough to supply all of Japan's requirements for more than 25 years.

Slide 6: Cameco's Operating Uranium Mines
Cameco produces its uranium at two large, high grade mines in northern Saskatchewan and from two smaller operations in the United States. The ore at the two large, high-grade mines - Key Lake and Rabbit Lake - will soon be depleted.

Cameco has, for many years, carried out large scale exploration programs to identify new sources of uranium.

Slide 7: Cigar Lake and McArthur River
In the 1980's the Cigar Lake and McArthur river ore bodies were discovered in northern Saskatchewan. These are unlike any other uranium orebody in the world. By way of comparison, the combined reserves identified so far in these two orebodies would be sufficient to supply all of the western world's uranium needs for more than 5 years - and the total extent of the reserves has yet to be determined.

Now, a very brief overview of these two projects.

Slide 8: Cigar Lake
First, Cigar Lake.

Slide 9: Cigar Lake
The Cigar Lake project is operated by the Cigar Lake Mining Corporation ("CLMC") which has completed underground test mining of the deposit.

Slide 10: Cigar Lake Ownership
The ownership of the Cigar Lake project is shown on this slide.

The President of Cigar Lake Mining Corporation is Mr. John Tosney and I would like to thank John for his contribution to this presentation.

Slide 11: Cigar Lake Reserves
The reserves at Cigar Lake are more than 350 million lbs of U_3O_8 in ore grading about 14% U_3O_8.

Slide 12: McArthur River
Turning to McArthur River.

Slide 13: McArthur River
Cameco is the operator; and the general manager of the McArthur river project is Mr. Brian Jamieson. I would like to thank Brian for his contribution to this presentation.

Slide 14: McArthur River Ownership
The owners of the McArthur River project are Cameco and Cogema.

Slide 15: McArthur River Reserves
Pods 1 and 2 shown here occupy less than 20% of the total strike length of the McArthur River orebody.

Ten days ago we announced that the reserves at McArthur River increased by 35%.

The reserves in Pods 1 & 2 now stand at 255 million lbs U_3O_8 at an average grade of 17% after allowing for mining dilution.

Combined with the mineralization identified in the remaining, less-fully explored portion of the orebody, the combined reserves and resources are 483 million lbs at an average grade of 15%.

Our experience so far has been that each time more detailed drilling has been done, the reserves have increased.

WHY AUTOMATION ?

Slide 16: Comparison of Grades
In addition to the large quantities of uranium contained in these two deposits, the ore grade, which averages around 15% U_3O_8, is about seven times the grade of the high-grade Key Lake mine, and about 100 times the average grade of uranium mines elsewhere in the world.

We are fortunate to have such high-grade orebodies. However, the radiation associated with the high grade presents some technical challenges. We must contend with gamma radiation from the mass of ore as well as alpha radiation from the associated radon gas.

Slide 17: Ore Depth

In addition to the challenges presented by radiation, the fact that both orebodies lie more than 450 metres below surface and are contained in rather unstable rock formations with high water pressures, further complicates the mining process.

Slide 18: Technical Challenges

The main technical challenges are:

Ground water:	at depths of 450 to 600 metres, with connection to surface water pressures of up to 850 psi (approx 60 bar)
Weak rock strata:	chemical alteration in sandstone and host rock extensive clay in and around orebody
Radiation protection:	high grade deposits radon-bearing water

Slide 19: Technical Solutions

Some of the technical solutions we have are:

Ground water:	primary development in tighter rock formations; ground conditioning such as grouting & freezing; rapid backfilling; and advancing under drill cover.
Weak rocks:	ground conditioning - grouting & freezing; ground support - conventional, (e.g. rockbolting, screening, shotcrete); non-conventional (e.g. concrete-lined tunnels); rapid backfilling; and minimizing blasting.
Radiation protection:	non-entry mining; remote control of mining equipment; concrete roadways; shotcrete on walls and backs of drifts; total containment of ore; high volume, single-pass ventilation; and training & monitoring.

Slide 20: Automation

Before talking about mine automation, I would like to touch briefly on the continuum from mechanization to automation.

Over time, mechanization has been developed as a way to reduce labour and costs, to improve safety and productivity. Common mining examples would be the jumbo drill and the scoop tram.

Remote control of mechanized equipment has been developed to permit working in hostile environments such as unstable rock formations and areas of high radioactivity. Examples would be remote-controlled drills and scoop trams. These are in use at Cigar Lake and McArthur River.

Automation of mechanized, remotely controlled mining equipment would be possible if the environment is predictable and homogeneous and if the geometry of the orebody would permit. However at our mines, the mining environment is neither predictable nor homogeneous, so the mining equipment cannot be fully automated.

Robotics are a generation beyond automation and cannot be employed in the situation we have at our mines.

Slide 21: Automation at Cigar and McArthur
McArthur River and Cigar Lake projects utilize remote control, non-entry mining methods.

DEVELOPMENT / EXTRACTION

Now I will describe the rather unique approaches we are taking, and the equipment we will be using, to develop and exploit these world-class uranium orebodies.

Slide 22: Cigar Lake Mine Layout
This slide shows the mine layout for Cigar Lake.

Slide 23: Mine Development System "MDS"
At Cigar Lake, we need multiple entries under an orebody situated in difficult ground conditions. The mine development system or "MDS" is civil tunnel technology which we have adapted to suit our mining environment.

Some of the requirements for the mine development system are:
- be able to advance a 5m diameter heading at 5m/day
- handle variable ground conditions
- be mobile enough to work in multiple entries on multiple levels

Slide 24: Mine Development System
Here we can see the MDS prior to its test underground at Cigar Lake. The unit is 8m long (14m with container) and weighs 115 tonnes.

Slide 25: Mine Development System
Here we can see the crawler tracks which, when put in place under the MDS, make the unit mobile; and the prototype cutter wheel.

Testing of the MDS in the actual conditions underground at Cigar Lake identified the need to modify the cutter wheel.

Slide 26: Modified Cutter Wheel
Here is a drawing of the modified wheel with: disc cutters for hard rock, teeth for soft rock and a flat wheel-face which is needed to support the face of the drift.

Slide 27: Mine Development System
As the MDS advances through the rock, it constructs a concrete tunnel by installing concrete segments. This portion of the MDS installs the segments...

Slide 28: Segment of Tunnel Lining
Shown here. Each segment is made of steel-reinforced concrete, is 1m by 30cm thick, and weighs 1.7 tonnes.

Slide 29: Mine Development System (with thrust rams)
These thrust rams are used to push the tunnel lining segments into place (i.e. to set them) and to provide pressure for the cutting wheel against the drift face.

Slide 30: Cigar Lake Project (ground preparation)
To prepare the orebody for mining, the ore must first be frozen.

Slide 31: Freeze Pipes
We accomplish this by: drilling holes through the orebody, installing double-walled pipes in the drill holes; and pumping brine cooled to below minus 35 degrees Celsius. This slide shows the relative positions of the ore body, the freeze level and the production level. The freeze cross-cuts are 12 m apart and the holes are 2 m apart. Each hole extends up to 15m above the orebody and is typically 60m in total length.

Slide 32: Freeze Drill System
The freeze holes are drilled by a specially-designed freeze hole drill system which operates from inside the concrete tunnels constructed by the MDS. This system is 20 m long and consists of 3 cars. One car has the drill, another has the drill services, and the third is the supply or shuttle car. Why do we go to all this trouble? Mechanization of the freeze hole drilling reduces the number of people needed to carry out the work in this area - the area which has the potential for higher radiation exposure. Also, not shown here, is the single-pass ventilation and the exhaust control around the drill hole and collector.

Slide 33: Freeze Drill System
The actual freeze hole drilling system looks like this.....

Slide 34: Freeze Drill System
Here is a close-up of the drill itself.

Slide 35: Cigar Lake (jet bore mining method)
The requirements for the mining system at Cigar Lake include:

mine a cavity averaging 6m x 2m diameter;
advance through a preventor;
contain all cuttings and radon gas;
permit surveying of the cavity; and
backfilling.

The mining system which has been satisfactorily tested; and will be used at Cigar Lake when production begins; is the jet boring system. As the name implies, the hole is bored by a high-pressure jet of water coming from the jet bore tool.

Slide 36: Jet Bore Mining Method
As you saw in a previous slide, here is the freeze level and here is the production level from which we carry out the jet boring and the backfilling.

The test mining used a basic tool design which was fabricated locally. Seven cavities were mined out, surveyed and back-filled. The system operated quite satisfactorily.

The issues identified were: plugging, erosion of the waste rock, and difficulties with hard pitchblende.

Slide 37: Jet Boring Tool
We are currently working on a new tool design, including modifications to the nozzle and blade screen.

Slide 38: McArthur River Project
Now, if we can go back to McArthur River to look at the systems which will be used there.

Slide 39: McArthur Mine Layout
This is a diagram of the mine layout at McArthur River. In contrast with Cigar Lake, the McArthur river ore body is situated in such a way that most of the development work can be carried out in relatively stable ground, using conventional drill and blast techniques.

Slide 40: Freezing
However, as is the case at Cigar Lake, the ore at McArthur must be frozen before it can be mined. Both mines make use of a freeze plant and dedicated pipes for pumping the super-cooled brine to and from the underground heat exchangers. The heat exchangers cool a brine solution in the low-pressure cooling circuit and the brine circulates through the freeze pipes installed 2m apart in the orebody. It takes about 6 months to freeze the ground in the area to be mined.

Slide 41: Freeze Hole Drill
The need to freeze the ore is the same, but the more stable ground conditions at McArthur River allow us to use a less-complicated freeze hole drilling system. But we still have to deal with water pressures in excess of 850 psi (approx 60 bar).

Slide 42: McArthur River ("Raise Bore Mining Method")
The mining method which will initially be used at McArthur River is the raise boring method. This is a commonly-used method for such things as ventilation raises ore-passes and waste-passes, however, McArthur will be the only mine to use raise boring as the production method.

Slide 43: Raise Bore Machine
The raise boring machine currently underground at McArthur River has a 150 hp main drive motor, and generates a reaming thrust of 3400 kilonewtons @ 28 megapascals (764,000 lbs at 4000 psi). It can drill at angles of 90 to 45 degrees from horizontal and moves on its own crawler. It is configured for remote-control operation.

Slide 44: Raise Boring, #1
In order to mine uranium with a raise bore drill, drifts are developed above and below the ore body in barren waste rock. The barren rock shields the workers from radiation resulting from the large mass of high grade ore. The raise borer is situated in the upper drift and the operator is located "upstream" of the fresh air flow, some 20 metres away from the raise boring machine and operates it from there by remote control.

Slide 45: Raise Boring, #2
A pilot hole, about 30 cm in diameter, is drilled down through the orebody to the drift below, a distance of about 110 metres.

Slide 46: Raise Boring, #3
After the pilot hole has broken through the lower drift..

Slide 47: Raise Boring, #4
A reaming head is attached to the drill stem and the operator reams a short distance up the hole. As soon as the reaming head has cleared the back (or "roof") of the drift, a device called a maintenance gate is put in position under the hole.

Slide 48: Underground Ore Collection (Maintenance Gate)
The maintenance gate provides an interface between the bored hole above, and the ore collection unit below. It allows the reaming to continue even when the ore collection unit is not in place.

Slide 49: Underground Ore Collection (Seal)
At the top of the maintenance gate there is an inflatable rubber seal to ensure a tight fit against the back of the drift around the bore hole.

Slide 50: Underground Ore Collection (Ore Collection Unit)
The ore collection unit is mounted on skids and can be moved to and from the maintenance gates.

Slide 51: Raised Boring, Final
After the maintenance gate and ore collection unit are in place, the raisebore operator continues to ream the hole up through the ore. The coarse size falls into the ore collection unit, while the finer particles and the drill water are collected and pumped directly to the underground ore processing facility.

Slide 52: Reaming Head
The reaming head produces a circular hole about 2.4m in diameter. (If conditions permit, this may be increased to 3 metres.) Each raise boring machine will complete 2 raises per month, or 24 raises per year. After each hole has been completed it will be backfilled with concrete.

Slide 53: Raise Boring (Plan of Reamed Holes)
This is a plan view showing the drilling pattern. Each 2.4m diameter raisebore hole will produce 50,000 to 500,000 lbs U_3O_8, depending on the thickness and grade of ore encountered by the hole. On average, each hole will produce 200,000 lbs U_3O_8 so each raisebore machine will produce, on average, about 5 million lbs U_3O_8 per year. Five million lbs is about 25% of the total uranium consumed in Japan each year.

ORE PROCESSING

Slide 54: Underground Ore Processing
In both Cigar Lake and McArthur River, the ore will be processed underground.

Slide 55: Underground Ore Processing (Grinding)
First, through a grinding circuit.

Slide 56: Underground Ore Processing (Thickening)
Then thickened.

Slide 57: Underground Ore Processing (Slurry Hoisting)
Then the slurry will be pumped to the surface through pipes in dedicated bore holes.

In all of these underground ore processing areas we have used the principles of radiation protection - including shielding of equipment, single-pass ventilation and control of radon gas through dedicated exhaust circuits.

Slide 58: Slurry Load Out
On surface, facilities are being constructed which will collect the slurry, blend for grade control, thicken it and load the slurry into specialized containers

Slide 59: Ore Trucked to Mill
The containers will be trucked to our existing uranium mills for processing into U_3O_8 (or "yellowcake"). We have used this type of container for many years at our conversion facilities in Ontario. Each truck is designed to carry 4 containers, averaging 18 tonnes of ore per trip.

The planned rate of production is 18 million lbs U_3O_8 per year from each of Cigar Lake and McArthur River. In comparison, Key Lake, currently the world's largest uranium mine, produces 14 million pounds per year.

Because of the high grade of the ore, at full production each mine will have to send fewer than 10 trucks like this per day to maintain a production rate of 18 million lbs per year.

Slide 60: Summary
To summarize:

Some of the non-mining systems at Cigar Lake and McArthur River such as hoisting, pumping, water treatment, underground ore processing, ore handling, slurry load-out, etc. are fully automated. But most of these are not unique to the uranium mining industry, and have not been included in today's presentation.

The weak rocks, high water pressures and radiation in the Cigar Lake and McArthur River mines have made it not only desirable, but also necessary, to automate our mining equipment.

However these same factors (weak rocks, high water pressure and radiation) make it impossible to fully automate the system. The optimum degree of automation at these two mines has been found to be the adaptation, modification and remote-controlling of traditional mining equipment.

I hope that you now have at least an impression of some of the methods we are employing which, in the uranium mining industry, are unique to Cigar Lake and McArthur River.

Thanks very much for your attention.
DOMO, ARRIGATO, GOZYIMASHITA

Mine Automation and Uranium Mining

W.L. (Bill) Murphy
Director, Marketing - Asia & Canada
Cameco Corporation

Contents

1. Overview	概　要
–Cameco	－Cameco 社
–Cigar Lake	－シカーレイク
–McArthur River	－マッカーサーリバー
2. Why Automation?	なぜ自動化なのか？
3. Development / Extraction	開　発／抽　出
–Cigar Lake	－シカーレイク
–McArthur River	－マッカーサーリバー
4. Ore Processing	鉱石処理
5. Summary	要　旨

Cameco

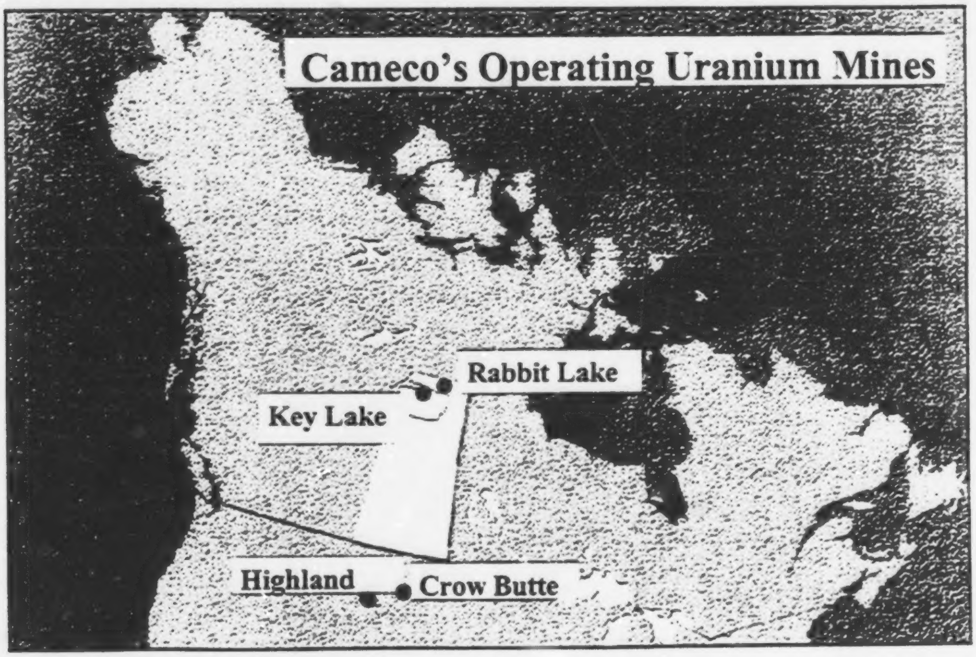
Cameco

- World's largest uranium producer
- 世界最大のウラン生産者
- 1,400 employees in North America
- 北米に従業員1400人
- 57 million shares
- 57百万株

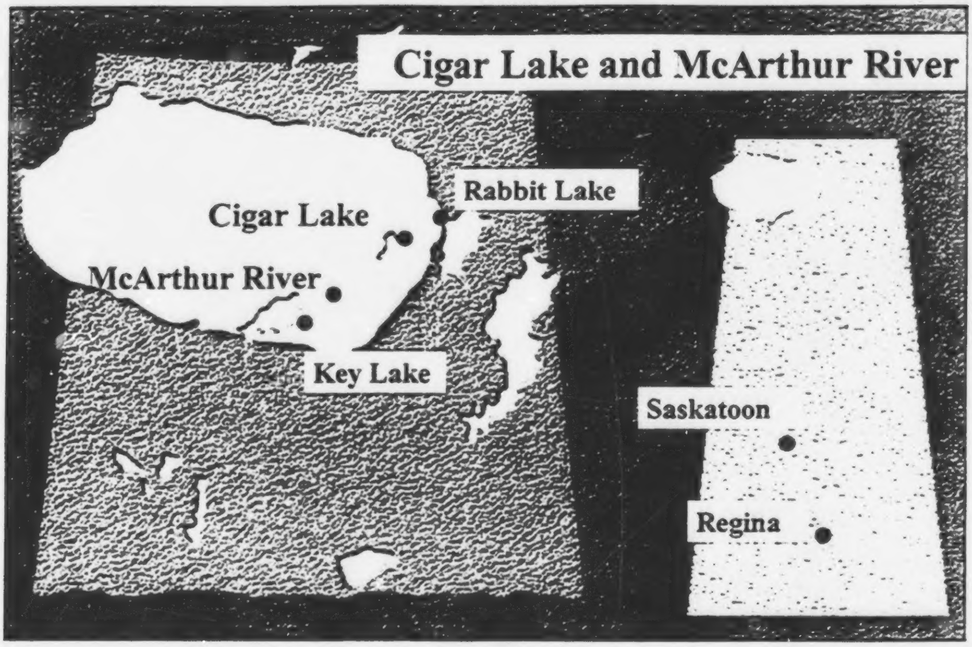
Cameco

- 40% of Western World uranium production
- 西側世界ウラン生産量の 40%
- Reserves and Resources to supply all of Japan's reactors for 25 years
- 日本の原子炉に 25 年間供給するだけの埋蔵量及び資源量

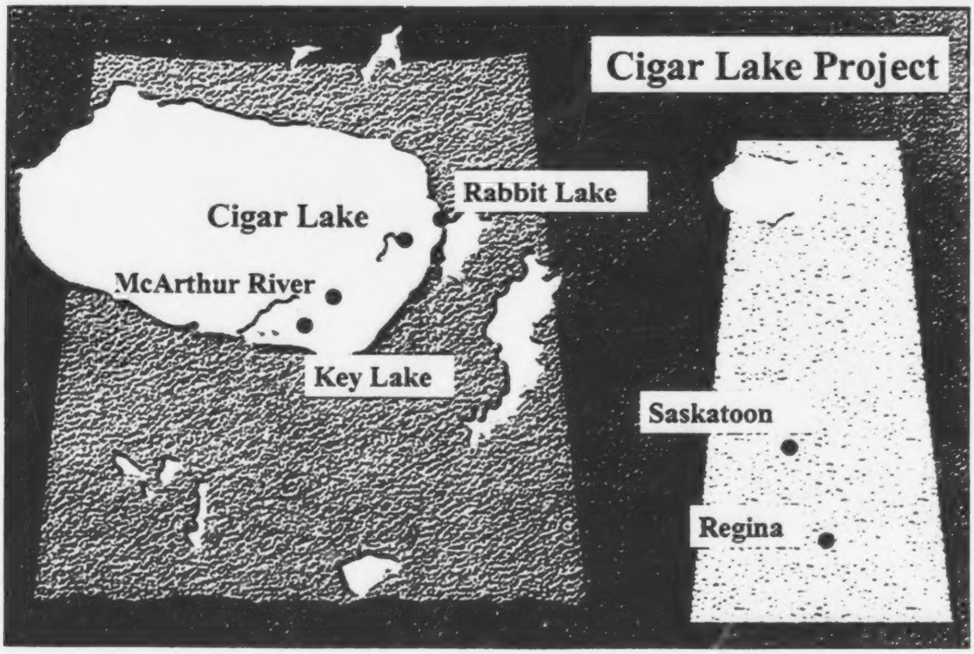
Cameco's Operating Uranium Mines


Rabbit Lake
Key Lake
Highland
Crow Butte

Cigar Lake and McArthur River

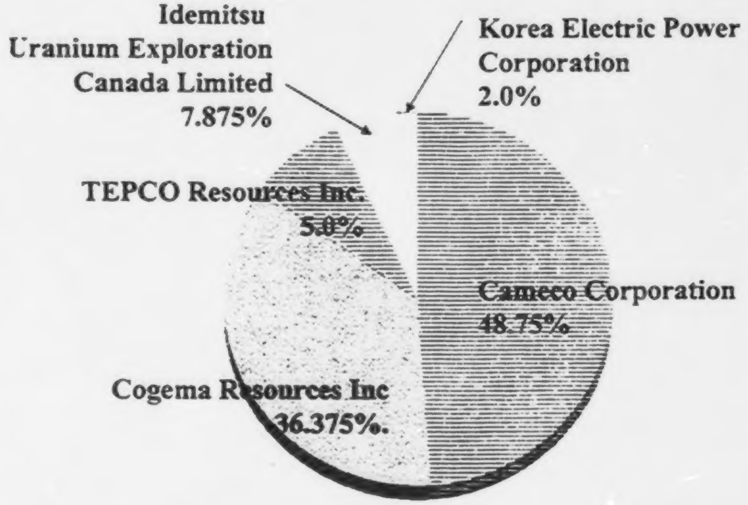

Rabbit Lake
Cigar Lake
McArthur River
Key Lake
Saskatoon
Regina

Cigar Lake Project

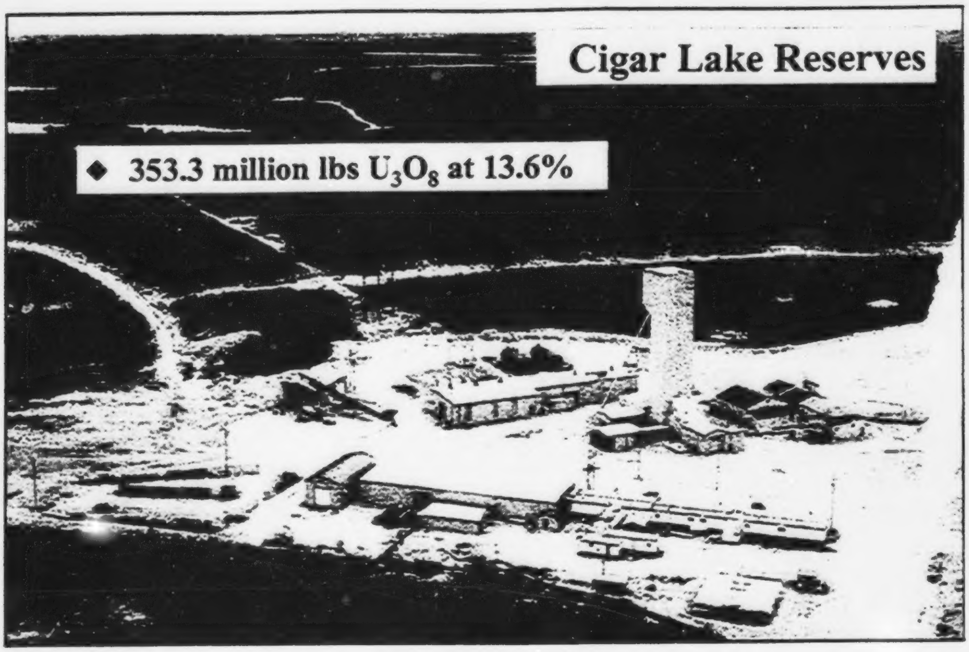

Rabbit Lake
Cigar Lake
McArthur River
Key Lake
Saskatoon
Regina

Cigar Lake Project

Cigar Lake Ownership

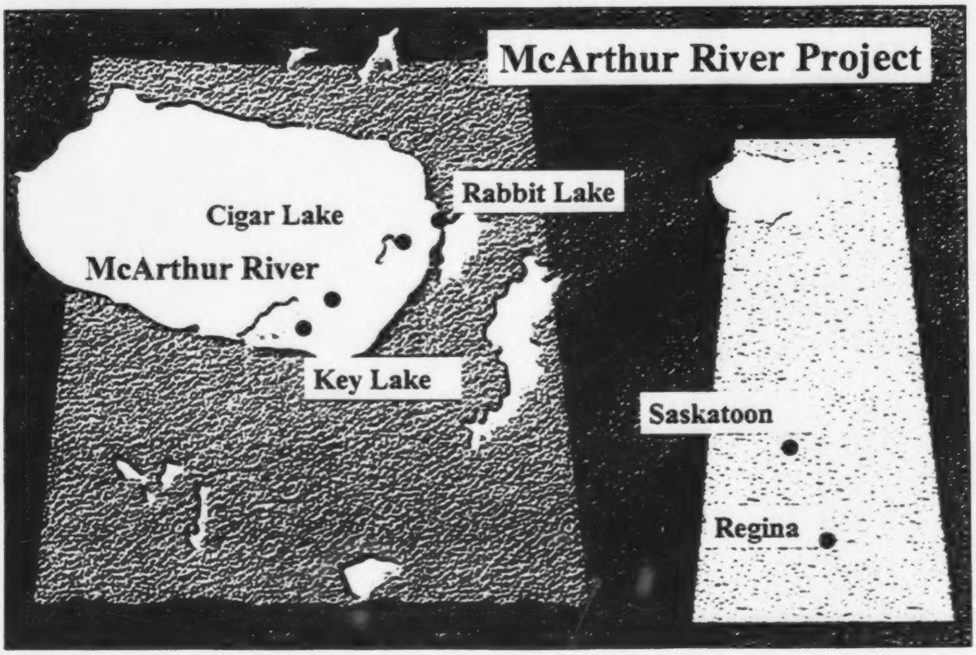


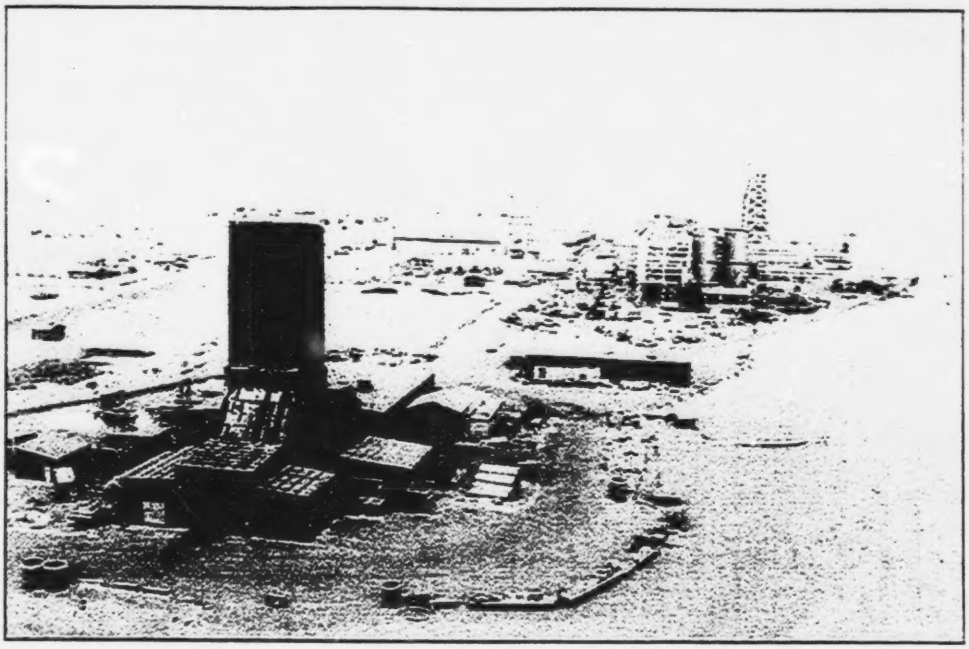
Cigar Lake Reserves

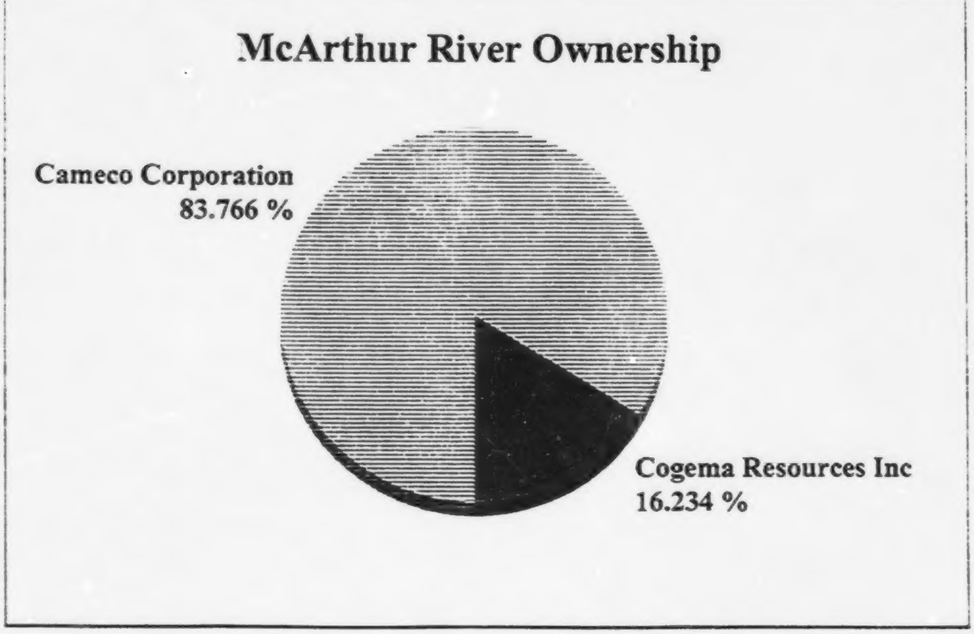


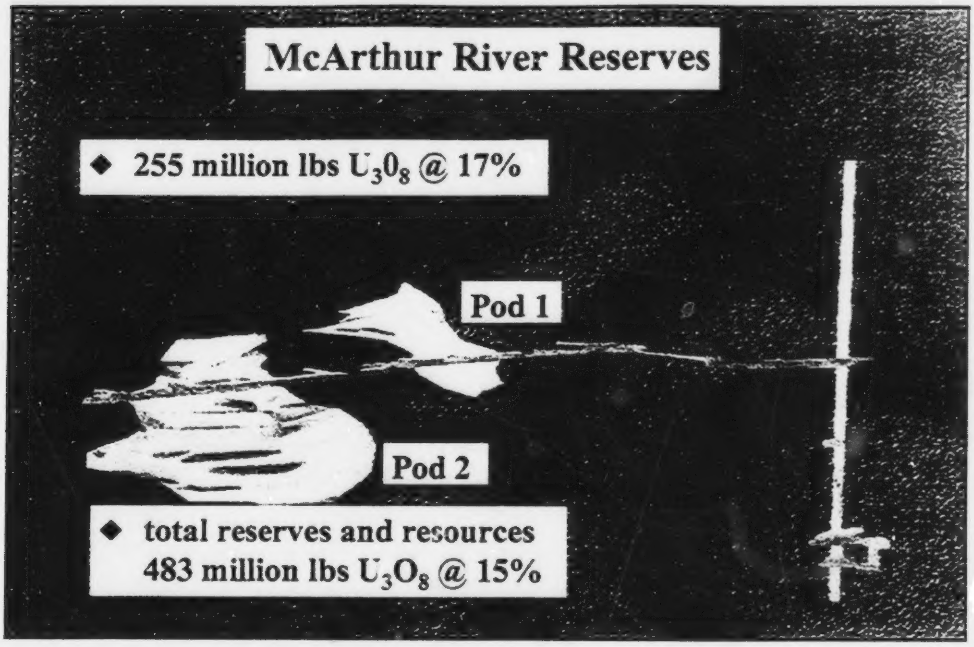
- ◆ 353.3 million lbs U_3O_8 at 13.6%

McArthur River Project


Rabbit Lake
Cigar Lake
McArthur River
Key Lake
Saskatoon
Regina



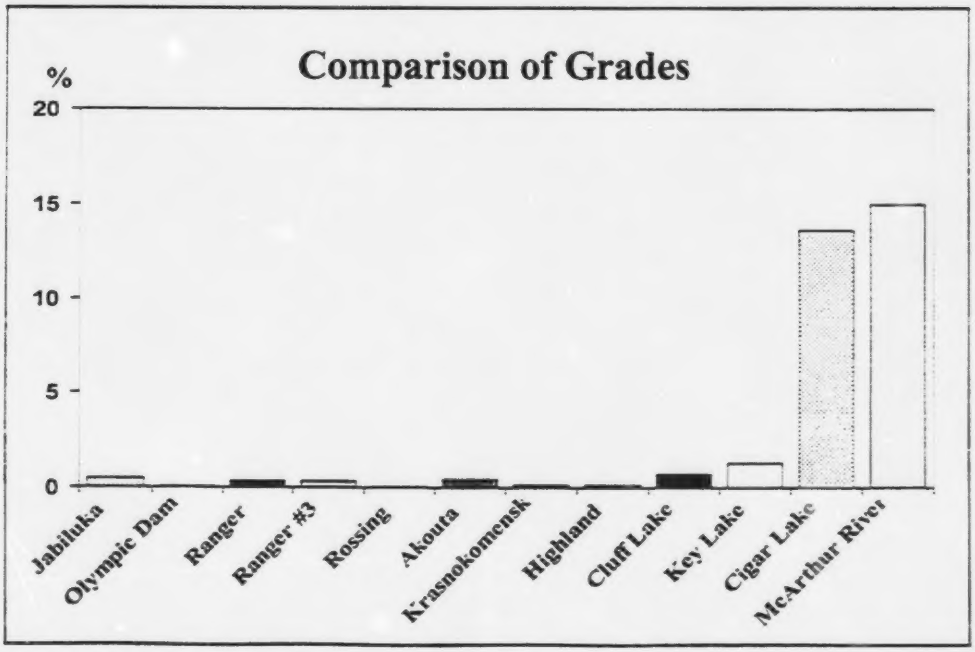

McArthur River Ownership
Cameco Corporation
83.766 %
Cogema Resources Inc
16.234 %



McArthur River Reserves

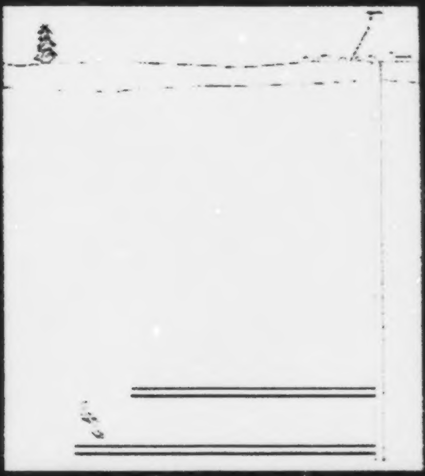
- 255 million lbs U_3O_8 @ 17%

- total reserves and resources
  483 million lbs U_3O_8 @ 15%



Comparison of Grades

Ore Depth: 450 - 600m

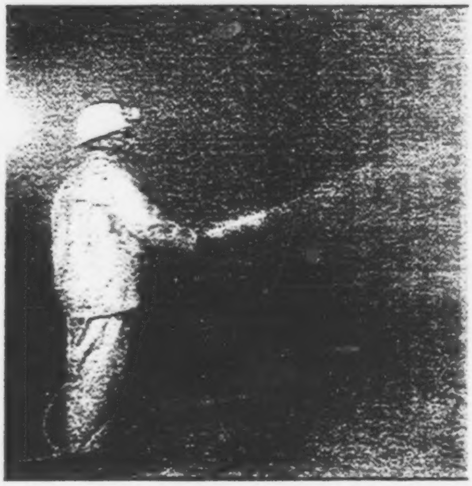


Technical Challenges

- Ground water
- 地下水
- Weak rock strata
- 脆弱な岩石層
- Radiation protection
- 放射線防護

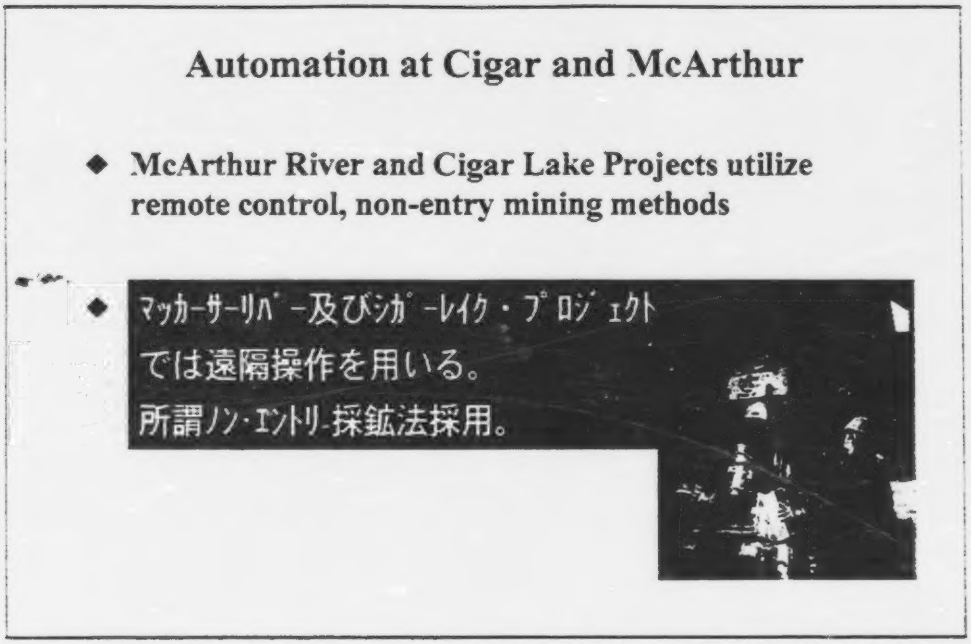
Technical Solutions

- Ground water
- 地下水
- Weak rock strata
- 脆弱な岩石層
- Radiation protection
- 放射線防護



Automation

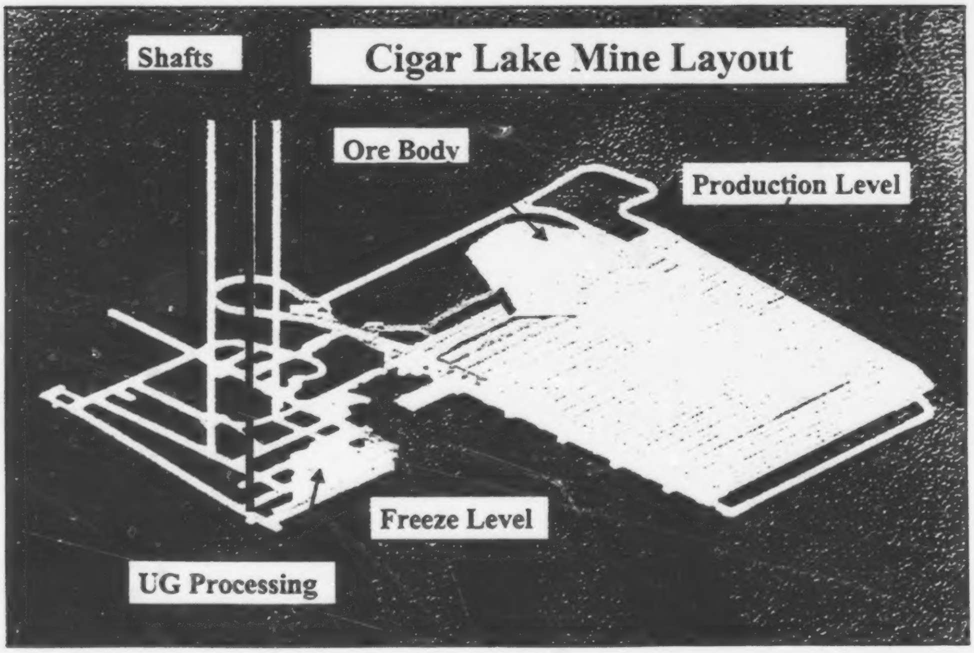
- Mechanization
- 機械化
- Remote Control
- 遠隔操作
- Automation
- 自動化
- Robotics
- ロボット化



Automation at Cigar and McArthur

◆ McArthur River and Cigar Lake Projects utilize remote control, non-entry mining methods

◆ ﾏｯｶｰｻｰﾘﾊﾞｰ及びｼｶﾞｰﾚｲｸ・ﾌﾟﾛｼﾞｪｸﾄ
では遠隔操作を用いる。
所謂ﾉﾝ･ｴﾝﾄﾘｰ採鉱法採用。



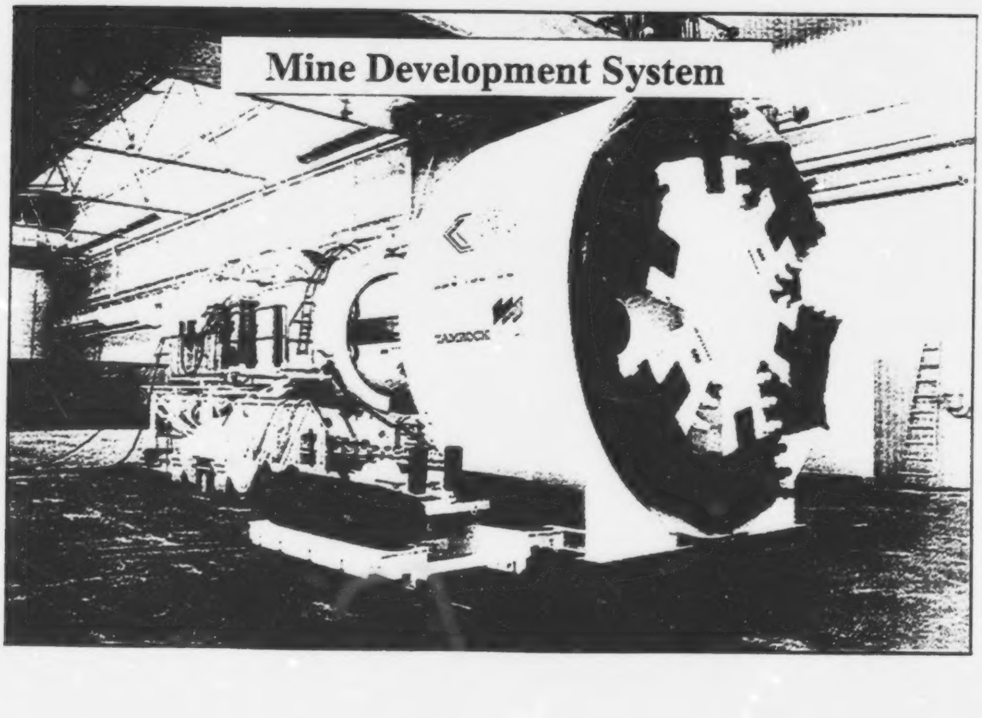
Cigar Lake Mine Layout

Shafts
Ore Body
Production Level
Freeze Level
UG Processing

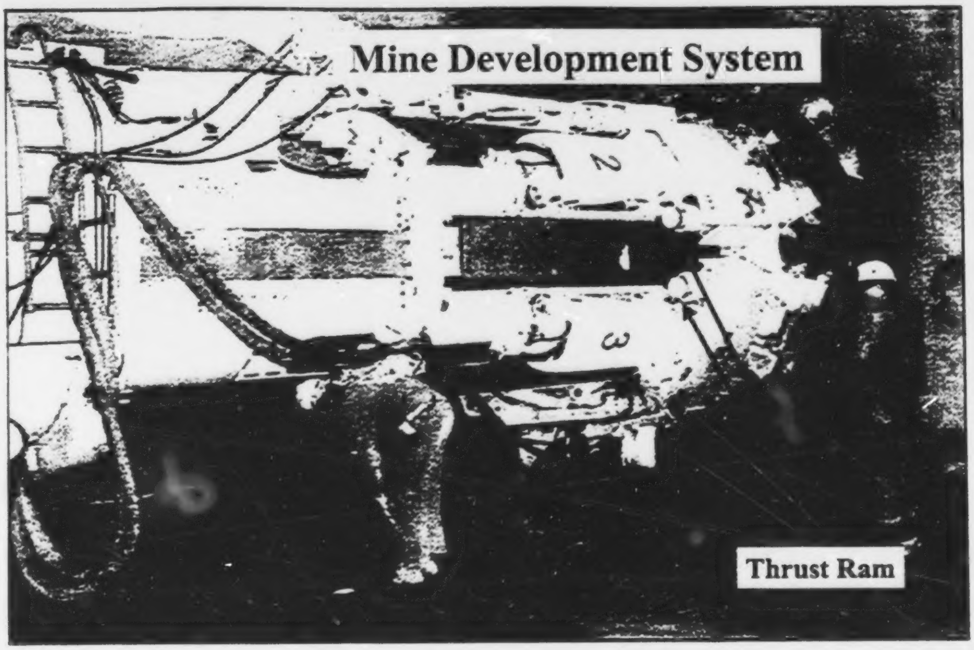
Cigar Lake Project

Mine Development System - "MDS"

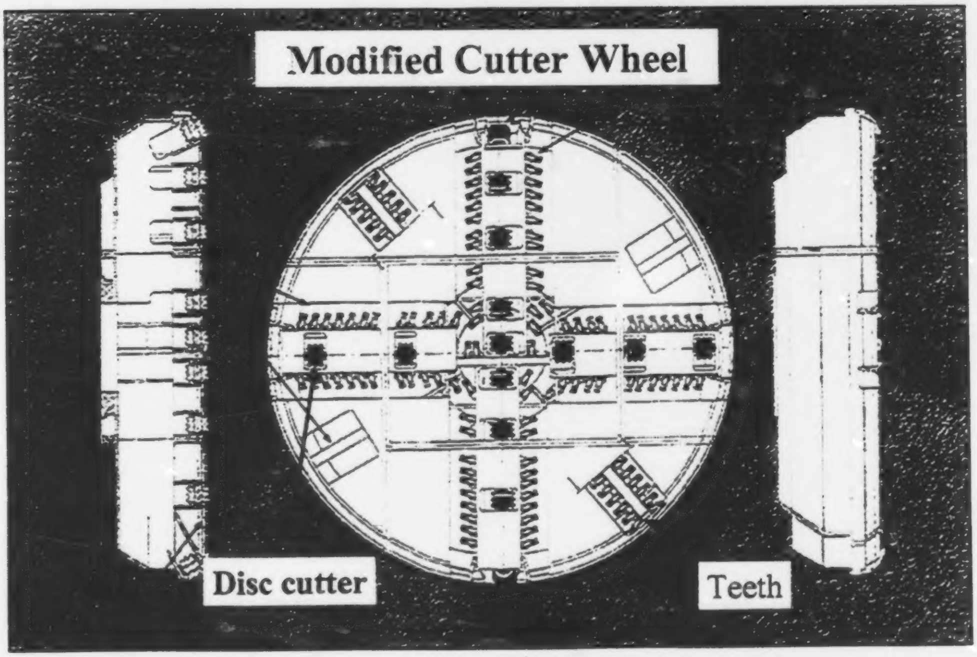
鉱山開発システム－ "MDS"



Mine Development System

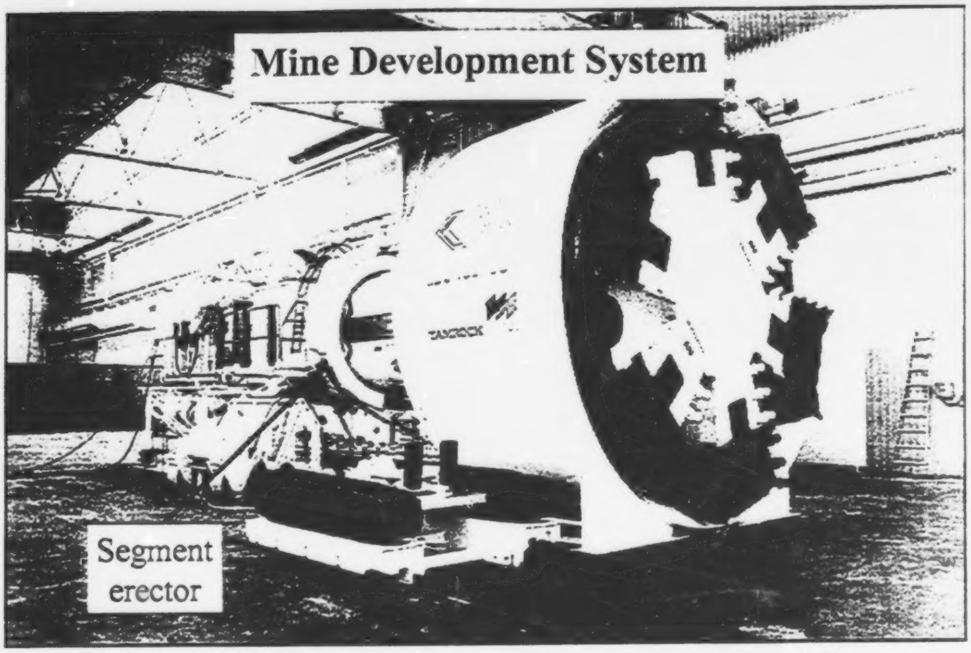


Mine Development System



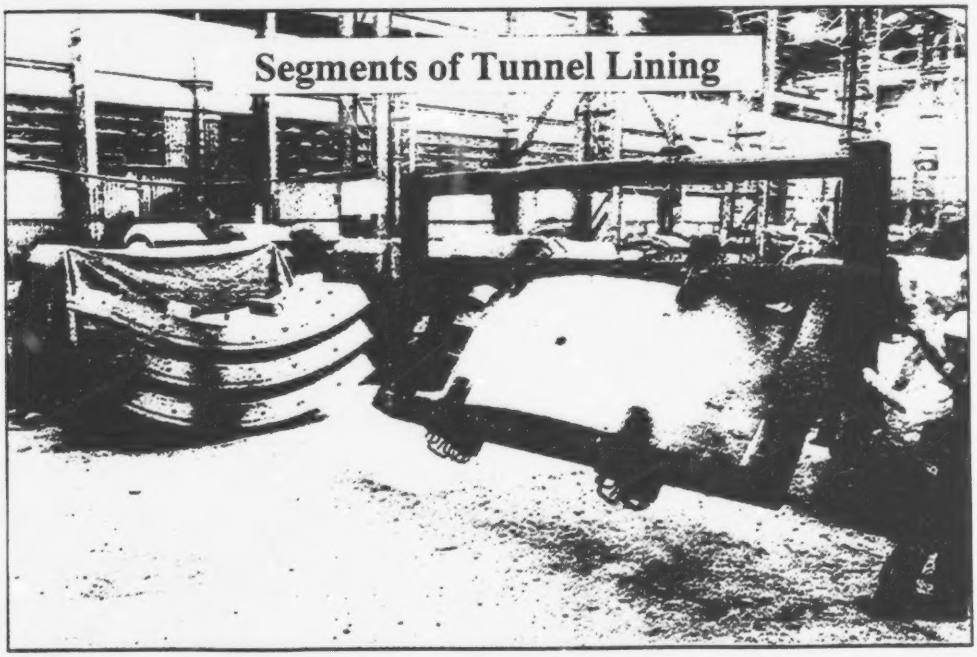
Modified Cutter Wheel

Disc cutter
Teeth



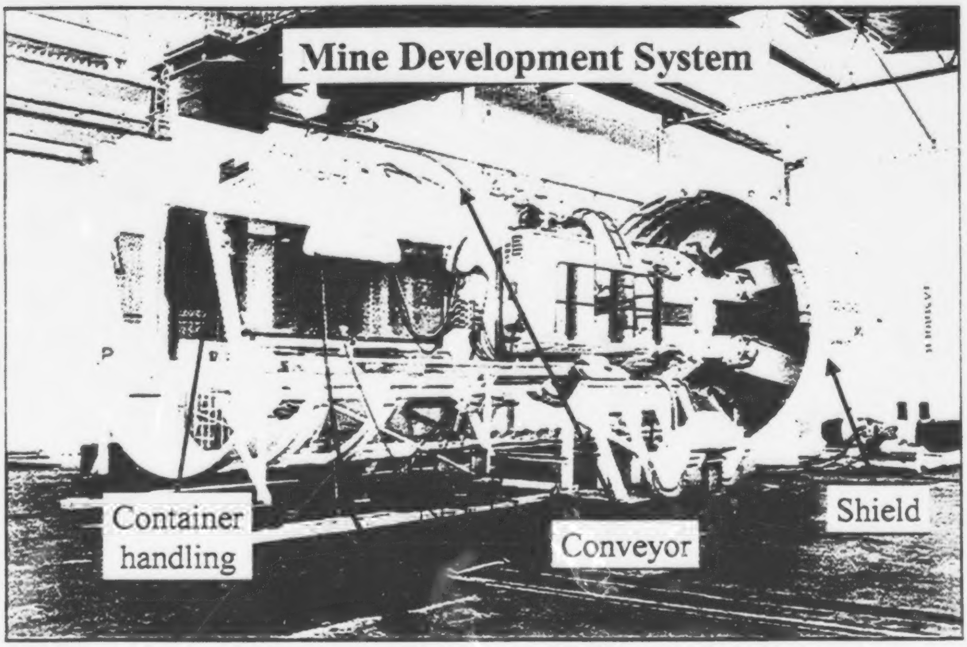
Mine Development System

Segment erector
TAMROCK



Segments of Tunnel Lining

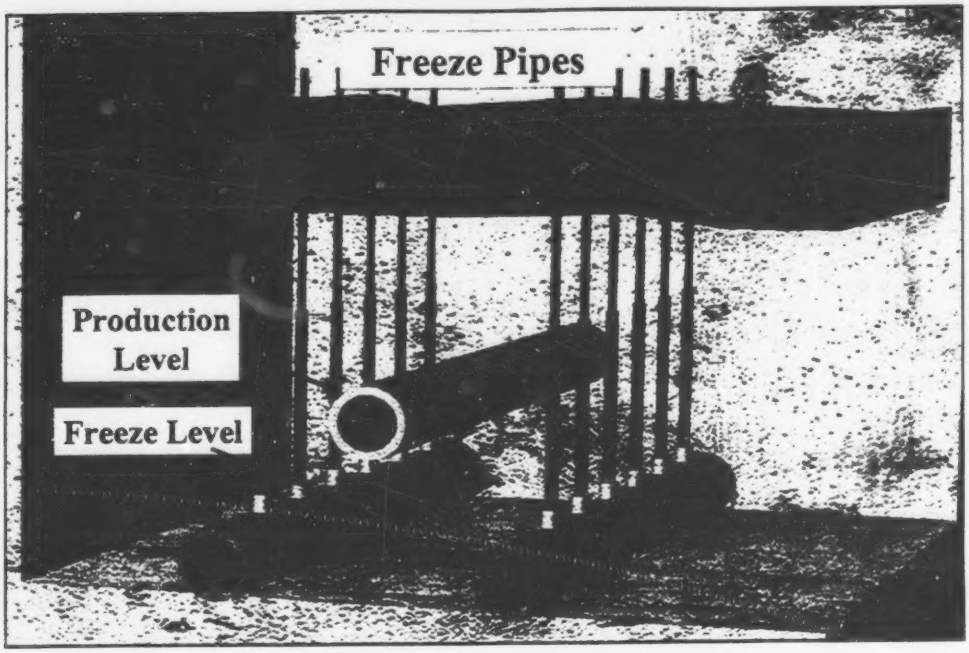
Mine Development System

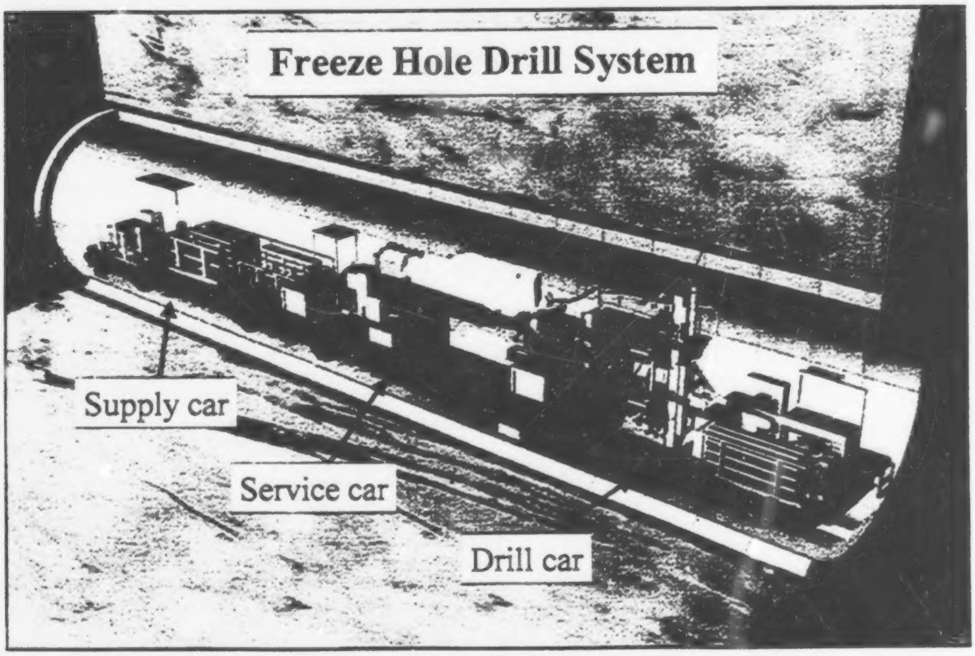

Container
handling
Conveyor
Shield

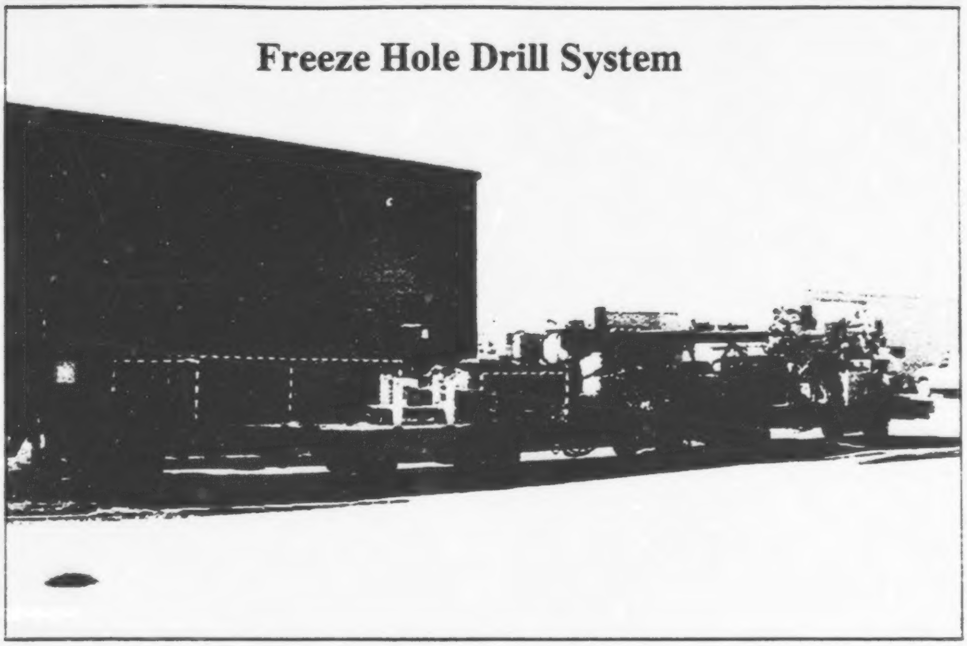
Cigar Lake Project

- ◆ **Ground Preparation**
  - freezing the ore

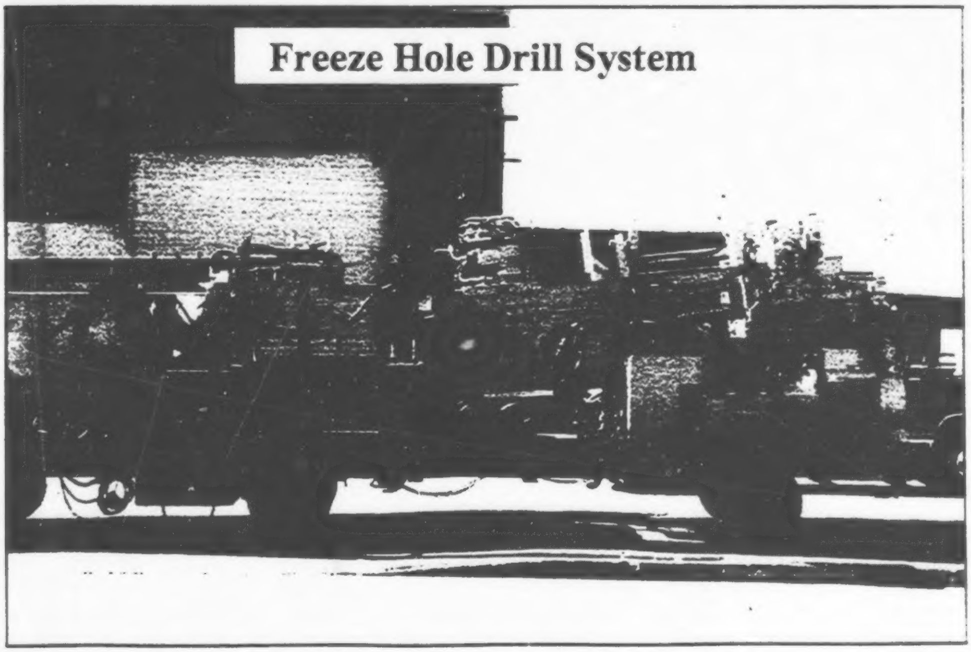
- ◆ 岩盤準備
  ー鉱体の凍結


Freeze Pipes
Production Level
Freeze Level


Freeze Hole Drill System
Supply car
Service car
Drill car



Freeze Hole Drill System

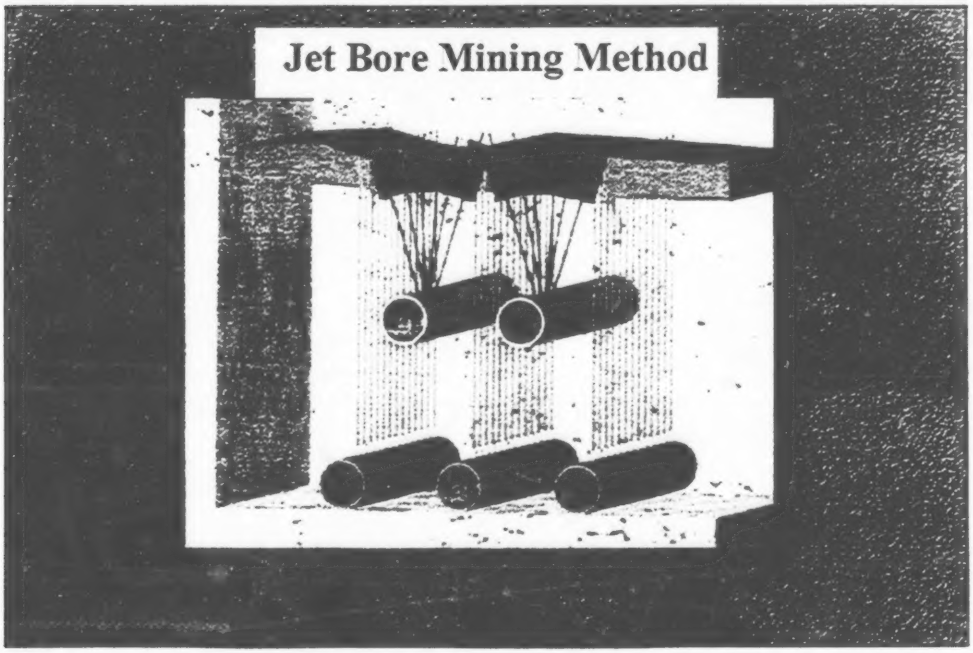


Freeze Hole Drill System

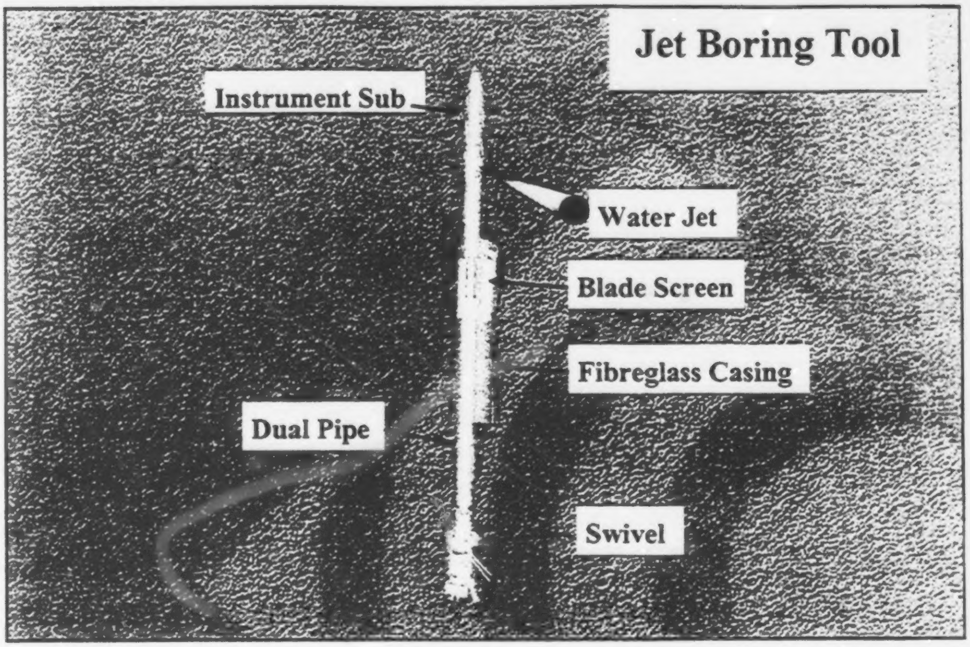
Cigar Lake Project

Jet Bore Mining Method

ジェット・ボア採鉱法

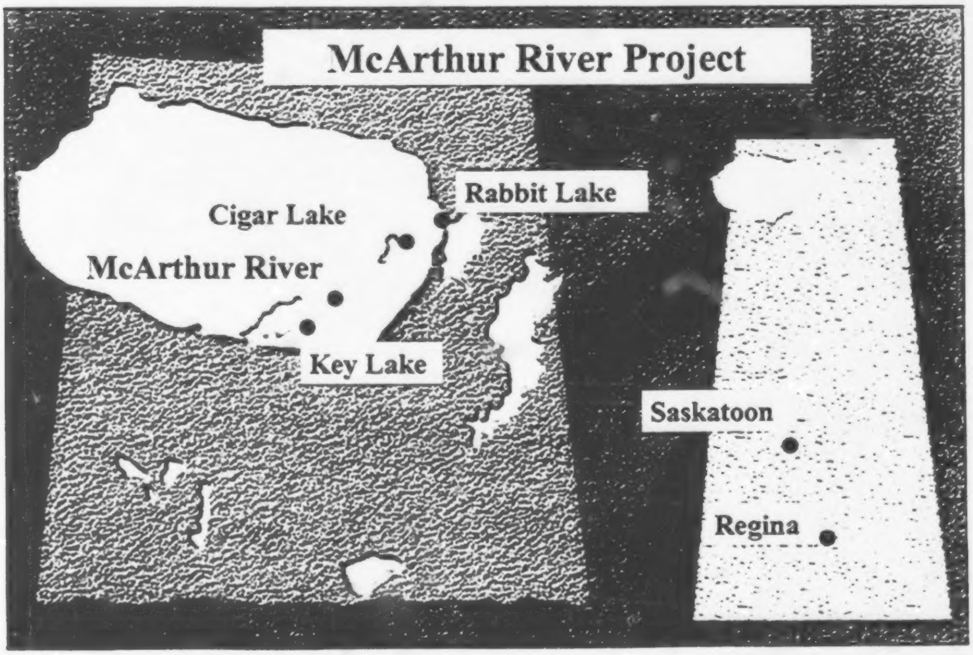


Jet Bore Mining Method



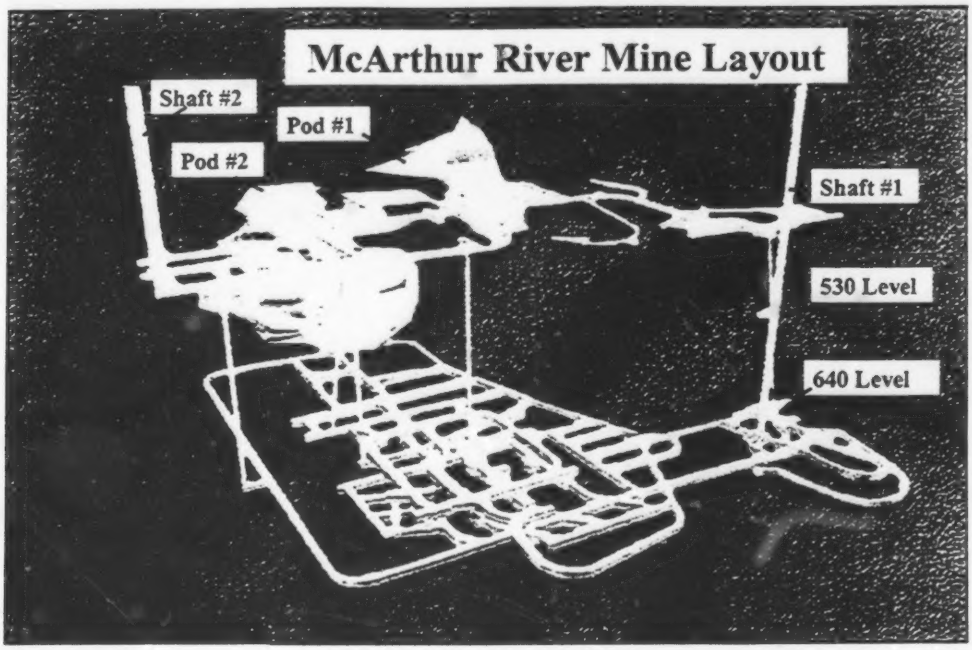
Jet Boring Tool

Instrument Sub
Water Jet
Blade Screen
Fibreglass Casing
Dual Pipe
Swivel



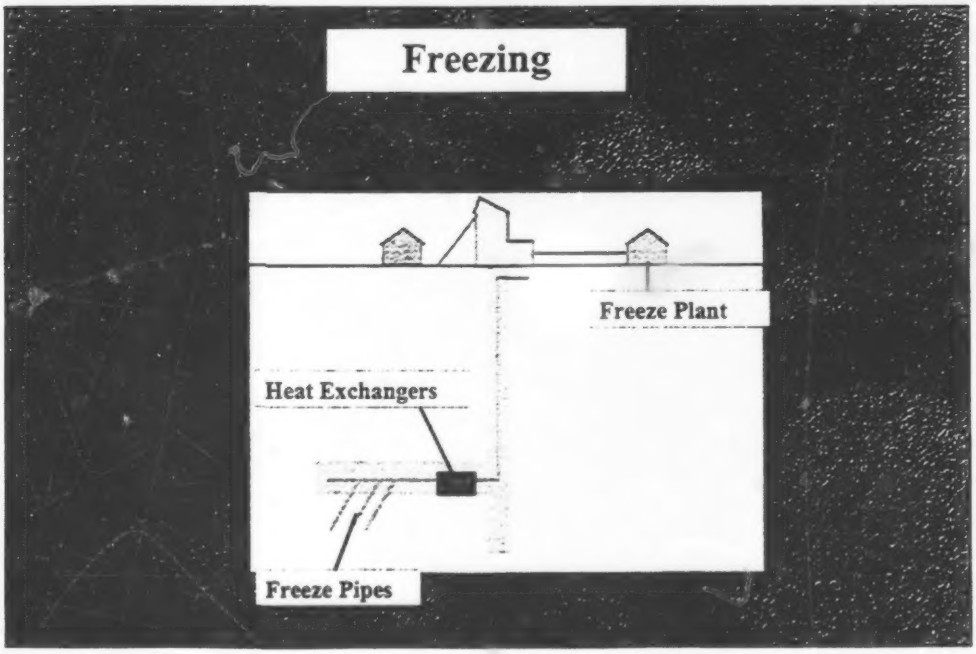
McArthur River Project

Rabbit Lake
Cigar Lake
McArthur River
Key Lake
Saskatoon
Regina



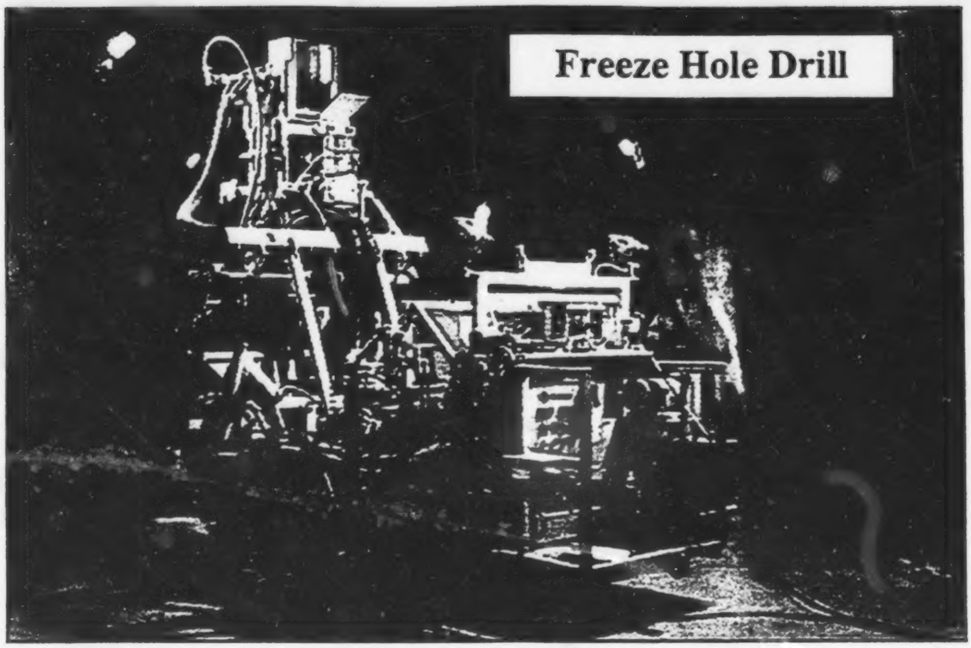
McArthur River Mine Layout

Shaft #2
Pod #1
Pod #2
Shaft #1
530 Level
640 Level



Freezing

Freeze Plant
Heat Exchangers
Freeze Pipes


Freeze Hole Drill

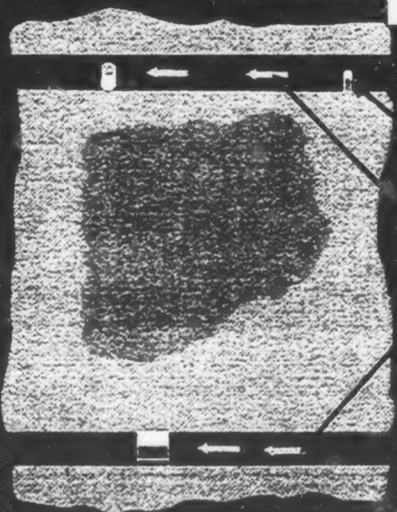
McArthur River

Raise Bore Mining Method

レイズ・ボア採鉱法

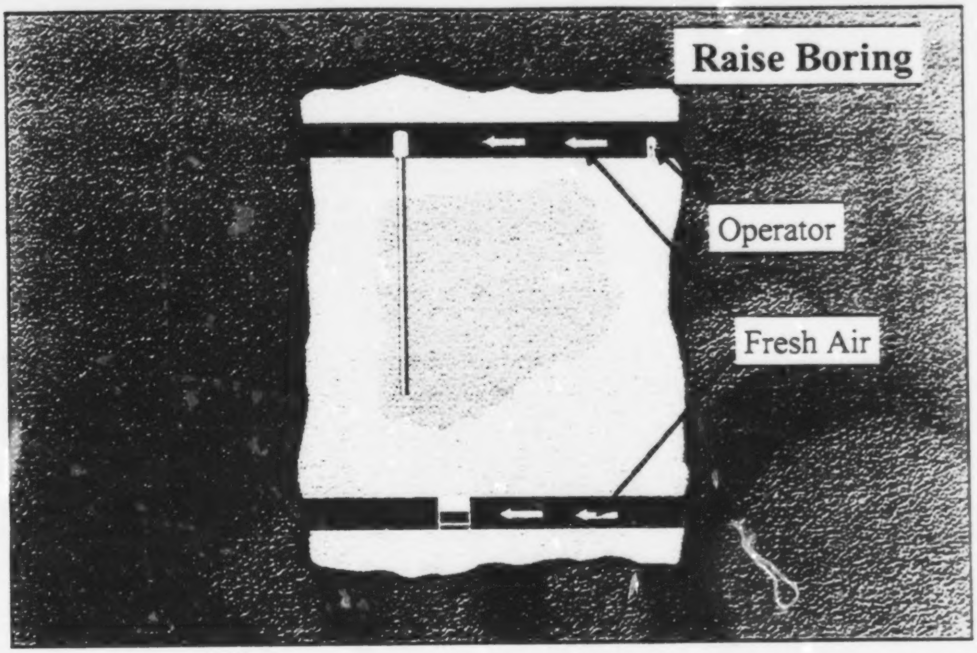
Raise Bore Machine

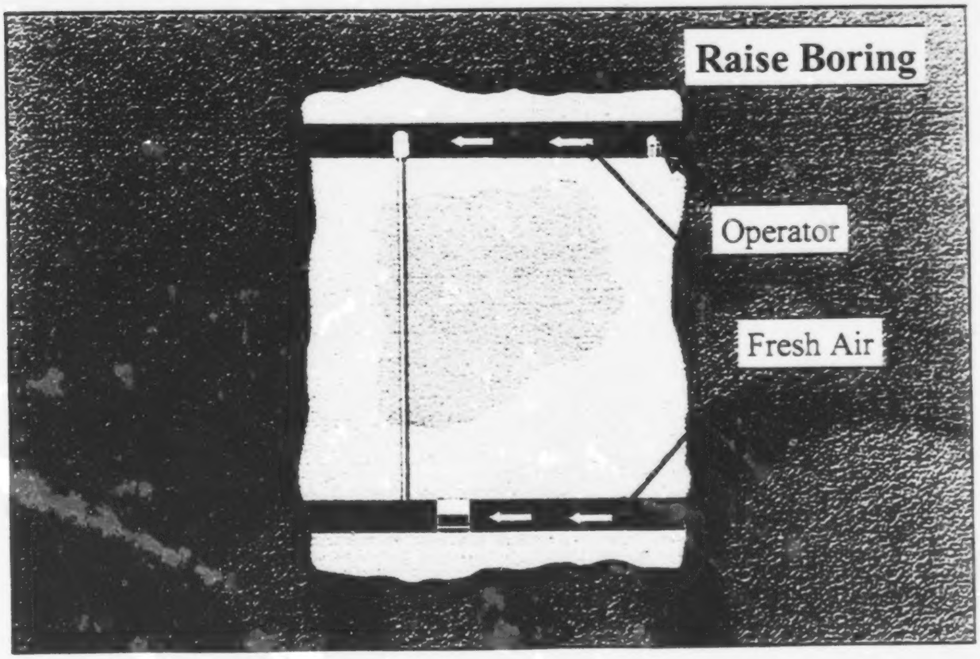
Raise Boring



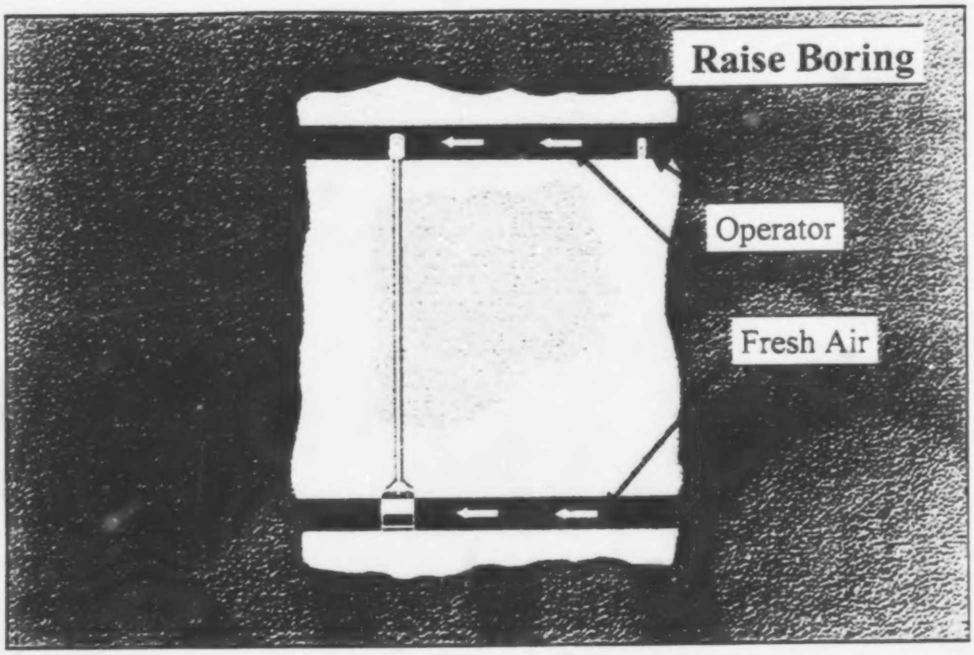
Operator

Fresh Air

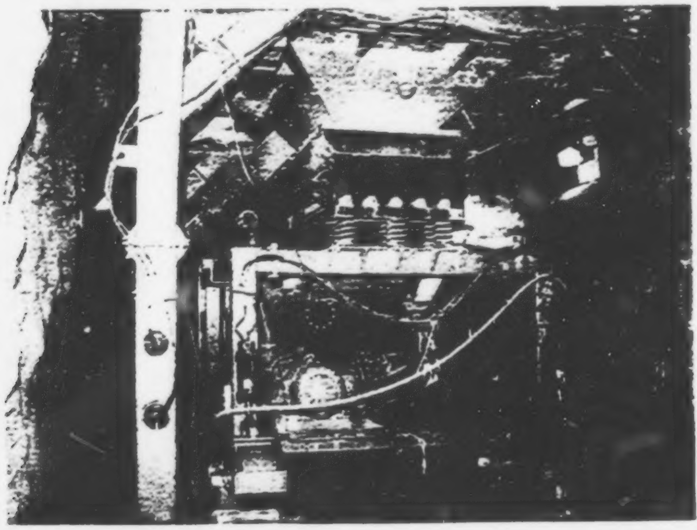

Raise Boring
Operator
Fresh Air


Raise Boring
Operator
Fresh Air

Raise Boring


Operator
Fresh Air

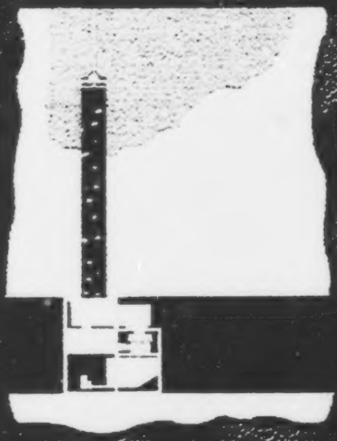
Underground Ore Collection



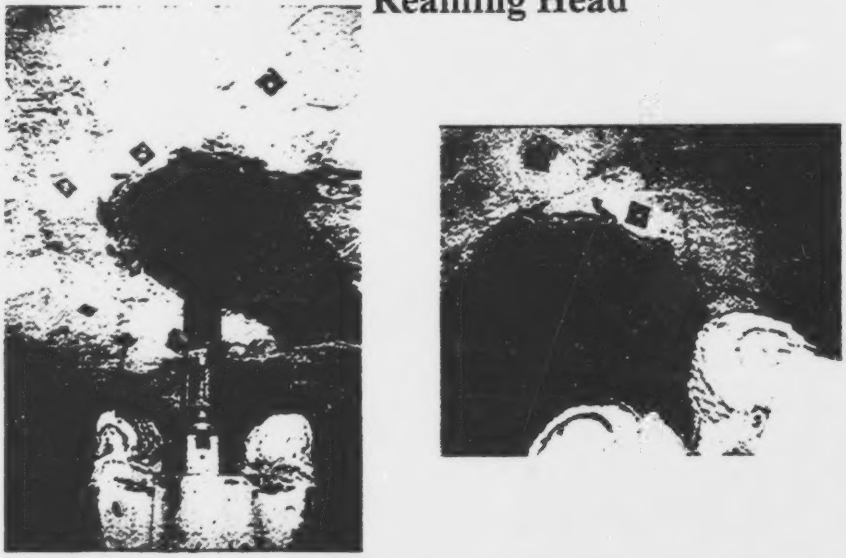
Underground Ore Collection

Underground Ore Collection

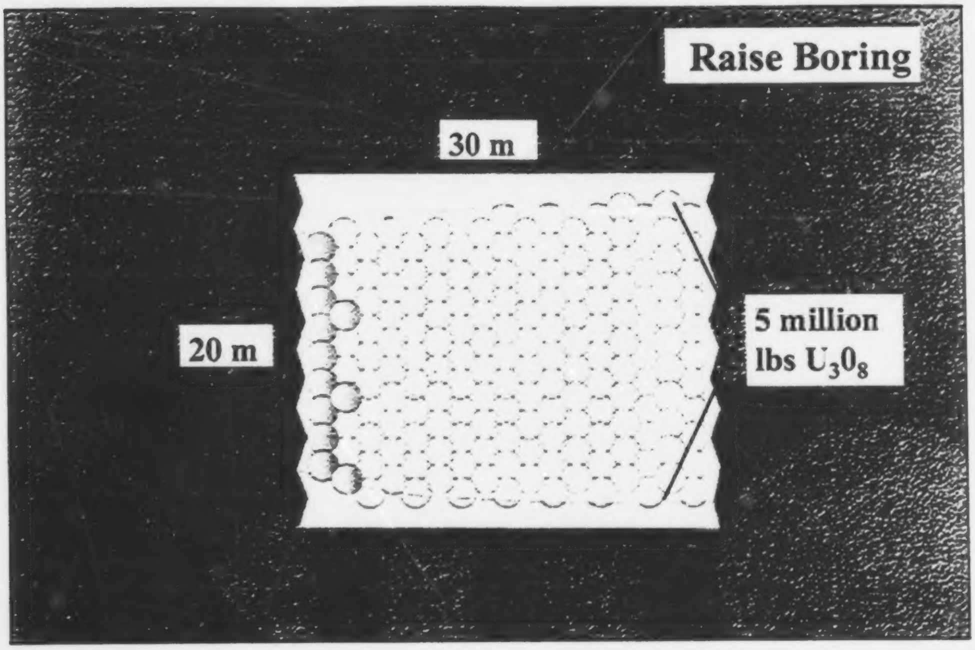
Raise Boring



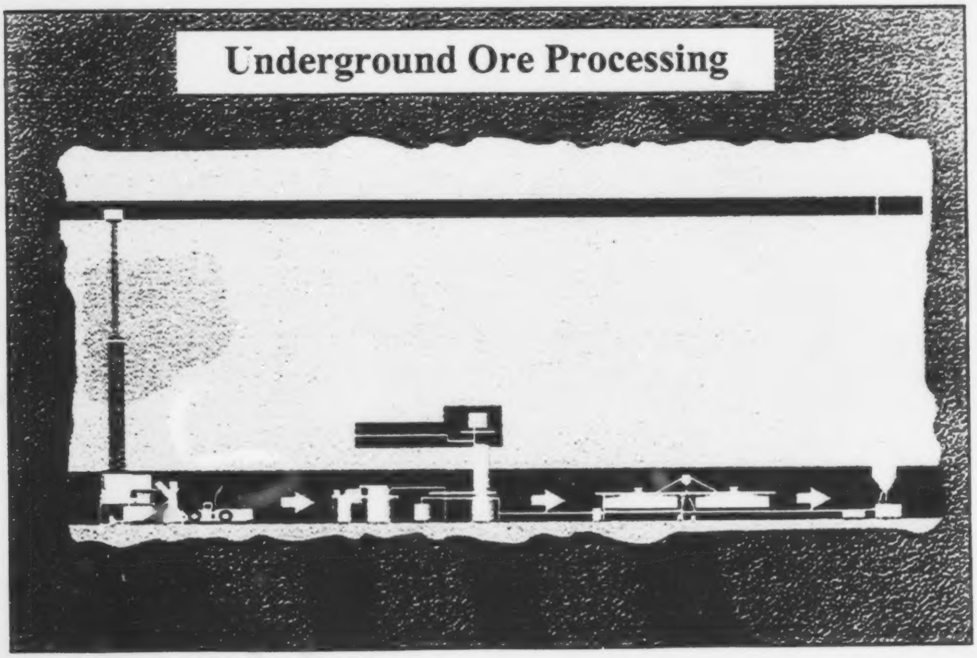
Reaming Head

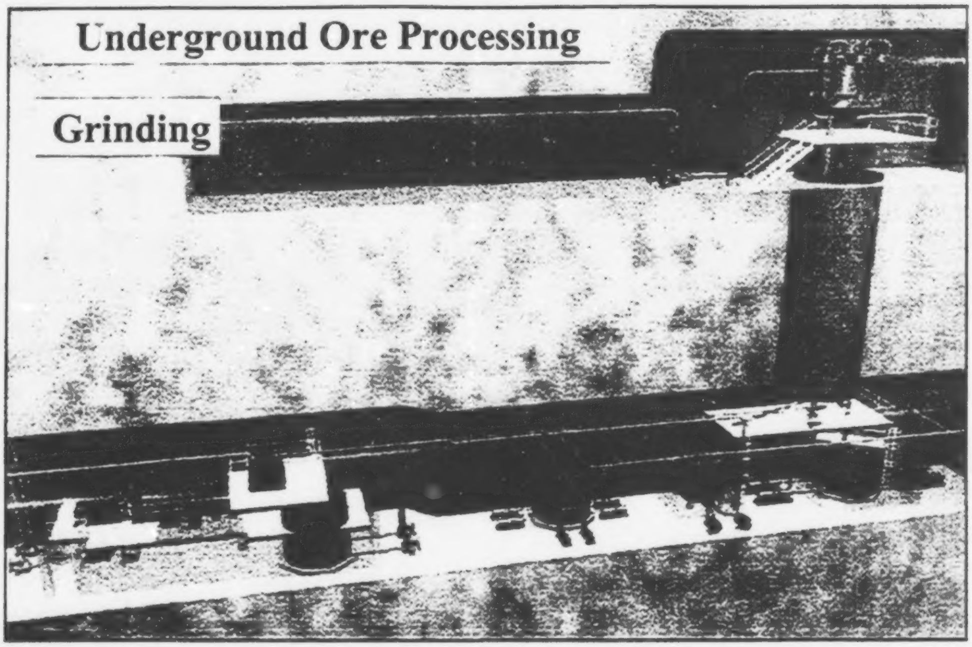


Raise Boring


30 m
20 m
5 million
lbs U_3O_8

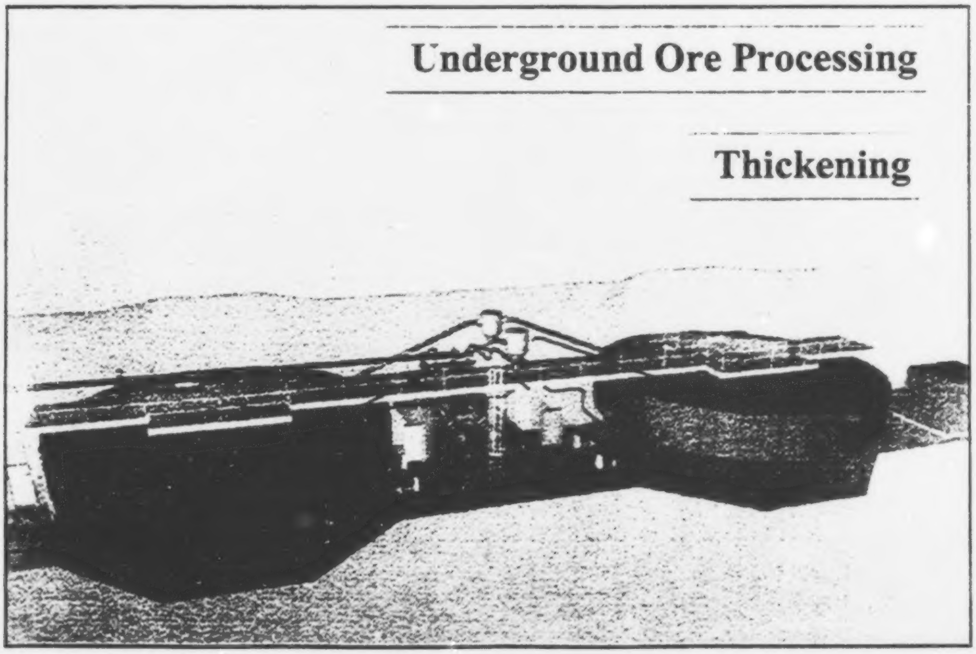
Underground Ore Processing





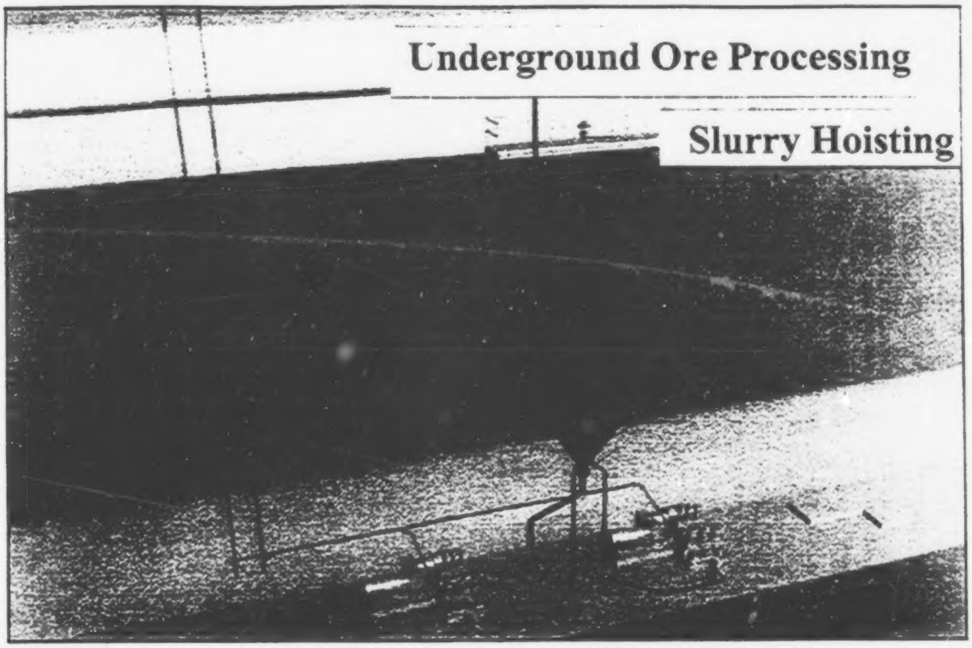
Underground Ore Processing

Grinding



Underground Ore Processing

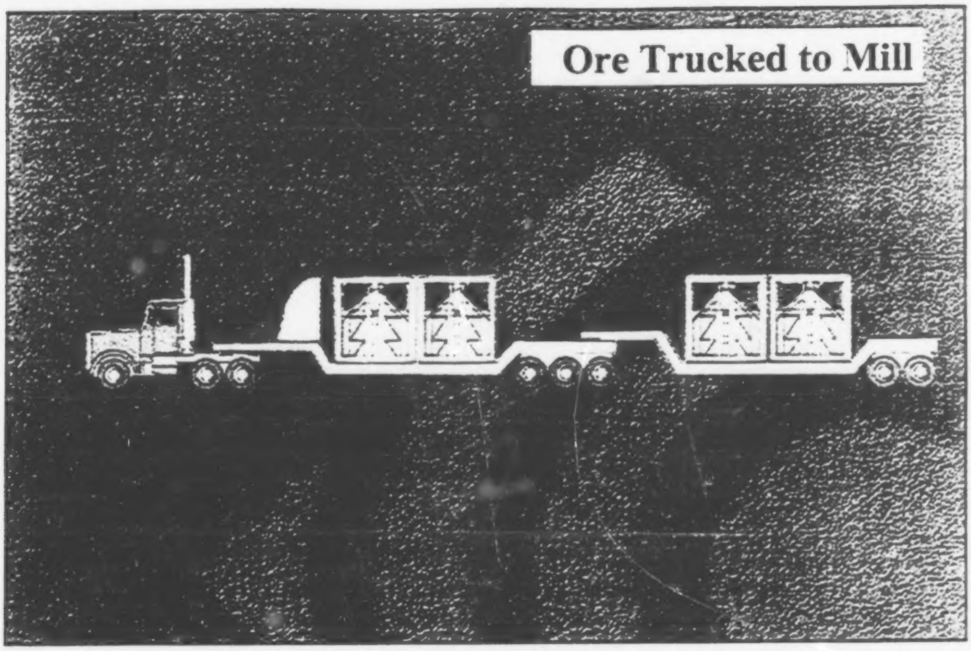
Thickening



Underground Ore Processing

Slurry Hoisting

Slurry Load Out


Ore Trucked to Mill

Summary

- Many non-mining systems are fully automated
- 採掘以外でも多くの
  システムが完全に自動化
- Underground mining conditions:
  – require a level of autototal automation
- 地下採鉱の条件：
  –ある程度の自動化は必要
  –完全な自動化は排除

Noranda: Growth Through Technology

Dr. Irwin Itzkovitch
Senior Vice President
Shared Business Services and Chief Technology Officer
Noranda Inc.

CANADA: A WINDOW ON GLOBAL MINING
World-Class Technology and Investment Prospects
Canadian Embassy, Tokyo, Japan
February 17, 1999

Dr. Irwin Itzkovitch

Senior Vice President,
Shared Business Services and Chief Technical Officer,
Noranda Inc.

Dr. Irwin Itzkovitch joined Noranda in 1995 as Senior Vice President, Technology and Director of the Noranda Technology Centre. In 1998, he was named Senior Vice President, Shared Business Services and Chief Technical Officer.

Dr. Itzkovitch obtained his Ph.D. in chemistry from Queen's University in 1970. He also completed the Executive Management Program at the University of Western Ontario Business School in 1989.

Irwin began his career at Inco Research as a Senior Research Scientist, before moving to the Ontario Research Foundation in 1974 as Head of the Hydrometallurgy Group. He then joined Eldorado Resources Limited of Ottawa in 1979, where he progressed to Manager, Research & Business Development. In 1987, he joined Sherritt Ltd. as Manager, Business Development. In 1990, he joined Natural Resources Canada as Director, Mineral Sciences Laboratories. In 1994, he was named Director General of the Mineral Technology Branch, before joining Noranda in 1995.

Dr. Itzkovitch is past Chairman of the Canadian Research Managers Association, past President of the Canadian Nuclear Society, and a past member of the Executive and Board of Directors of the Metallurgical Society, Canadian Institute of Mining and Metallurgy (CIMM). He is a member of both the Canadian Ministers of Natural Resources, and State for Science and Technology Advisory Councils on Science and Technology.

Other key achievements include providing input into Industry Science and Technologies Canada's strategic technology initiative in Biotechnology and Advanced Industrial Materials, and Environment Canada's initiatives in Metal Mining Liquid Effluent Regulations.

Dr. Itzkovitch has over 20 publications to his credit, and four patents. He resides in Toronto and is married with three children. His interests include community service, baseball and reading.

Noranda: Growth Through Technology

Slide 1: Noranda's Growth Through Technology
Thank you for the opportunity to speak at this conference on *World-Class Mining Technology and Investment Prospects*. This presentation will describe the major change that Noranda has undergone in the last year and the role technology has played in these changes.

Slide 2: Noranda: Over 75 Years of History
Noranda started with Ed Horne, a gold prospector who discovered one of this Century's great mineral deposits in a place where others said it couldn't exist: Rouyn-Noranda, Quebec, in 1922. This was the beginning of Noranda. (Where does the name come from? North Canada = Noranda = Noranda.) Although the mine closed in 1976, the Horne Smelter is still in operation - mainly due to new technology.

Slide 3: Strategic Changes
Just over a year ago we announced that Noranda was returning to its roots and focusing on the mining and metals sector. The first step was the sale of Norcen Energy Resources, which was completed in the first quarter of this year. The final step was the distribution of Noranda Forest and Canadian Hunter to our shareholders. This was accomplished on Dec 31 of 1998.

Slide 4: Noranda - A Mining and Metals Company
Noranda today is very different from a year ago. We are a major mining and metallurgy operating company, which including our investment in Falconbridge, operates 23 mines. We are the worlds' largest purchaser of copper custom feed and operate 11 fabricating facilities worldwide. We employ about 21,000 people at operations and sales offices around the world and have a total asset base of almost $11 billion.

Slide 5: Noranda Today
We have operating facilities in 8 countries and office in 26 countries. We are one of the world's largest producers of zinc and nickel, a significant producer of aluminum, copper, lead, sulphuric acid, gold, silver, cobalt. A major recycler of secondary copper, nickel and precious metals, and in the year 2000: magnesium. Noranda is committed to environment, workplace safety and health. We apply our same policies and code of ethics everywhere we operate, even in other countries where local regulations are less restrictive.

Slide 6: Product Revenue Mix
This pie chart shows the makeup of our revenues after we have disposed of our forest and oil and gas assets. The 11% precious metals are mostly achieved from our metallurgical operations and not from our investment in Battle Mountain Gold. Other income is that of WRI, Rudolf Wolff, and other investments.

Slide 7: Geographical Revenue Source
Noranda's sells almost 80 % of its products to markets outside of Canada. Our competitive arena has become global; and being the best has come to mean the best in the world rather than only in Canada or North America. Our major market is the US, accounting for 56% of the 1997 revenue.

Slide 8: Our Objective
Going forward, our objective is to achieve a 12% return on equity over a full commodity price cycle. This will be achieved not only through cost reduction but also by profitable growth, being recognized by others as a company to partner with and instilling in everyone that works at Noranda a culture based on performance. Most of the rest of this presentation will focus on what we are doing to achieve this and the role technology plays in meeting this goal.

Slide 9: Our Road Map
We are focusing on basically two initiatives:

- Our margin improvement program; and
- The redeployment of proceeds from the sale of Norcen and other assets.

Both of these initiatives are highly dependent on technology.

Slide 10: Noranda Technology
For all of Noranda, as is the case with the Natural Resource industries, there isn't anything we do that doesn't involve technology. We recognize that Innovation and Technology allows us to continue to have a strong balance sheet and be cost competitive. It also allows us to maintain our strong environmental, health and safety practices.

Slide 11: Noranda Technology Centre
Noranda in Pointe Claire and Falconbridge in Sudbury have modernized and expanded their Technology Centres in a major way. The Noranda Technology Centre depicted here was opened in 1963 and expanded 4 times in the last 35 years. The collective investment in technology by Noranda and Falconbridge is about $69 million. Not only are the innovations excellent, they created large economic benefit and competitive advantage. Both companies also invest some $90 MILLION annually on exploration.

Slide 12: Margin Improvement Program - Progress to Date
Where are we today? So far, there have been over 300 projects identified, 2/3 of which are cost related and 1/3 revenue related. In 1998, we have realized about $60 million in annualized improvements simply as a result of picking the "low-hanging fruit". Our latest estimate has us exceeding our $285 million target.

Slide 13: Margin Improvement Projects
Margin improvement technology related projects run the full gamut from the Mine, to the metallurgical plant to fabrication.

Slide 14: Mine Automation
The first area I want to describe is our recent successes in mine automation at our zinc mine in New Brunswick.

Slide 15: Brunswick Zinc Mine
The Brunswick zinc mine is located in the Bathurst area of New Brunswick in Eastern Canada. This is the largest underground zinc mine in the world. The depth of mining is 1280 meters and we mine some 9300 tpd. We are experiencing significant seismic activities, resulting in the need to minimize human exposure and thus automation is used extensively.

Slide 16: Mine automation
Noranda has been developing underground mining automation since 1989. Noranda's automation program is focused on the underground ore handling system, more specifically the loaders and trucks used to transport the blasted ore from its initial location to the various passes used to collect it.

Key technologies were developed. First, continuous radio communication between the control room and the mobile equipment was established using a Distributed Antenna System. The second key technology was teleoperation, which simply means remote control of equipment using video cameras. Next, computer control functions were added to the loaders and trucks.

Automatic control of the loading process was key to providing consistent full loads from the machines and reducing loading time. This resulted in a 10% increase in productivity per machine. Noranda is not in the Mining Equipment Business. So we've created a partnership with a Saguenay, Québec based company called STAS who, at the present time, is responsible for manufacturing, marketing and supporting mining technologies developed at the Noranda Technology Centre such as our Underground Vehicle Guidance System.

Slide 17: Weasel
Another technology which impacts both safety and productivity is the "Weasel". Brunswick Mining and Smelting underground personnel developed this remote-controlled machine to deal with large boulders generated from bad blasts or rock falls. This tiny mobile drill can weasel its way into an open stope, which might otherwise have to be abandoned. It drills, loads and drags a detonator wire back to safety for the operator to assists in the recovery of buried scoops.

Slide18: Cavity Monitoring System
The "Cavity Monitoring System" is a laser technology that accurately measures the volume and contours of underground mine excavations. It provides users with invaluable information on stope stability and allows mine operators to easily monitor ore loss and dilution. We've sold more than 80 units worldwide through a company called Optech.

Slide 19: CEZ Zinc Refinery
Our zinc refinery is in Valleyfield, Quebec. It is located alongside the St Lawrence River. It procures and processes zinc concentrate and has recently completed a modernization which has expanded it annual capacity by 11% to 250,000 tonnes of zinc metal per year. The cost of this expansion is one third of the capital cost of Greenfield capacity. One key technology that has been integrated into the plant is Jarofix a technology that deals with the disposal and treatment of residues and results in increased feed flexibility.

Slide 20: Jarofix Process
At Canadian Electrolytic Zinc, iron in concentrates is disposed of as ammonium Jarosite at a rate of 160,000 tonnes per year. This residue is stored in special ponds and, in 1992, an evaluation of 29 alternatives to Jarosite ponding was undertaken. The "Jaraofix Technology Option" - which consists of applying stabilisation and solidification process using Portland cement was the option of choice as an alternative.

Slide 21: Jarofix Process Flowsheet
Full-scale implementation occurred at the end of 1998. CEzinc is now successfully stabilising Jarosite. The process consists of dewatering the CCD washed Jarosite residue on belt filters.

Slide 22: Jarofix Process Flowsheet
Mixing the washed dewatered residue with lime and Portland cement, trucking it to disposal and eventually capping it with soil and grass. This process has created new standards in the zinc industry for processing iron residues. Other zinc refineries all around the world have expressed interest in applying this technology for treating their iron residues.

Slide 23: Zinc Powder Business
The full integration of technology in the Zinc Powder Business, and the continuous Improvement and/or Innovation Process has been occurring for a decade. Technology's role is to provide the Zinc Powder Business with the most effective technologies for making, improving and testing battery-grade zinc powder in order to market good products.

Slide 24: Our Road Map
The second initiative is the redeployment of our proceeds from the sale of Norcen and other assets.

Slide 25: Growth Initiatives
Noranda is growing. We are growing in all areas of our business. In the next few slides, I will focus on this growth and give you a sense of the role technology is playing in this. Also I have included some of the mining technologies, although not integrated into our current plans we are developing for the future.

Slide 26: Re-deploying Asset Sale Proceeds
Here is a list of the major projects that will generate our improved rates of return. Noranda currently and over the next few years is investing over $4 billion on this list alone. When you take into account the improved rates of return and the amount of money being invested, you can see that there will be a fundamental change in the ability of Noranda to generate earnings. We plan to invest more as these investments generate the cash flow. We believe that a 12% ROE is a very achievable objective.

Slide 27: Growth Technology
Some of the technologies that will be briefly described include are given on this slide but first let me describe two very exciting mining projects that Noranda is carrying out.

Slide 28: Collahuasi Copper Mine
The first is Falconbridge's Collahuasi copper mine in Chile. This is a photo of the open pit at the Ujina deposit located some 180 km southeast of Iquipue at approximately 4,400 meters above sea level. The porphyry copper mineralization consists of both copper-bearing sulphides and oxides producing 400,000 tonnes of copper a year. Production will combine 50,000 mt/yr SXEW and 350,000 mt/yr Cu in concentrate at cash costs below 50¢/lb. The oxide plant was completed in June 1998 and the first cathode was stripped on July 16, 1998.

Collahuasi is a partnership with Falconbridge's interest at 44%. Minorco has 44% and a Japanese consortium 12%.

Slide 29: Antamina Copper/Zinc Mine
The Antamina project is located in the Andes of Peru, about 385-km northeast of Lima at an altitude of 4,200 meters. It is being developed in partnership with Rio Algom and Teck Corporation. Noranda has 37.5% of the projects. We are currently in discussions with Japanese interests with respect to their participation in the project. It is expected to become the world's 7th. Largest copper mine and 3rd largest zinc producer. Estimated 20-year mine life with the potential to double the size of the deposit. Cash cost of 35¢/lb accountable Cu includes by-product credits. Mining will be open pit at the rate of 70,000 tonnes/day.

Noranda will purchase 75,000 TPA of zinc concentrate at arm's length terms and will also purchase all bornite copper concentrates for processing at existing operations. Both of these new mines will require significant technology, much of which exists in the portfolios of the partners.

Slide 30: General Mining
Noranda continues to develop mining technologies for the future. Two of which are Plasma Blasting and Virtual Mining.

Slide 31: PBT

The primary objective for PBT was to replace the conventional drill-and-blast mining cycle based on chemical explosives, with a technology that would reduce both costs and adverse environmental effects. The PBT process consists in generating a high-power electrical discharge in a liquid material to be blasted. A hole is drilled in the rock or concrete, the liquid is inserted, electrodes are introduced into the liquid and a discharge is generated. Heat generated by the discharge vaporises the liquid. The rapid expansion of the gas creates a shock wave that propagates in the surrounding solid and breaks it.

Slide 32: PBT Prototype

This is a picture of the prototype that was built. The PBT system consists of a drilling mechanism, an electrical discharge apparatus, and a mobile platform. The drilling and the platform subsystems are conventional devices. The innovation brought by Noranda resides in the electrical subsystem. It consists of a high-voltage capacitor bank, used to store electrical energy, a spark-gap switch, used to release the energy in some tens of microseconds, and a rigid coaxial conductor assembly forming the electrodes that deliver the energy to the target. A high-voltage DC power-supply serves to recharge.

We are currently in discussion with potential partners for the commercialization of this technology, which has wide application outside of metal mining.

Slide 33: Virtual Mining

In a similar vein we continue to develop automated mining technology which will have the effect of placing a miner on surface on the scoop tram through the use of stereoscopic camera's and headsets.

Slide 34: Smelting Technology

Another area of technology development is the creation of shareholder value from other people's wastes by building on a competency within Noranda in smelting Copper concentrates. A good example of this is at the Horne Smelter. It would not be possible to produce saleable copper at the Horne, one of the world's premier custom smelters, without the application of advanced technologies. We couldn't treat hundreds of thousands of tons of very complex or dirty ores and scrap each year --- from 200 separate customers and 18 countries, without the most sophisticated of modelling techniques and a profound understanding of complex metallurgical reactions. Today, 25 years after the mine shutdown, this smelter is a world leader in the technologies of recycling and quality control, making Noranda North America's largest dollar-value recycler.

Slide 35: Horne Smelter

At the Horne Smelter we are creating shareholder value from other people's wastes by building on a competency within Noranda in smelting Copper concentrates. A good example of this is at the Horne Smelter. It would not be possible to produce saleable copper at the Horne, one of the world's premier custom smelters, without the application of advanced technologies. Today, 25 years after the mine shutdown, this smelter is a world leader in the technologies of recycling and quality control, making Noranda North America's largest dollar-value recycler.

Slide 36: Altonorte Smelter
Another recent investment by Noranda was the purchase and expansion of a copper smelter in Chile. The Altonorte copper smelter is located in the northern part of Chile, 25 kilometers southeast of Antofagasta. We acquired a 25% interest in 1995 then the remaining 75% earlier this year. It is located in one of the highest growth areas for copper mine development in the world and we have recently announced plans to expand capacity. This smelter has the potential to be the lowest cost smelter in the world and has good acid credit. Phase III expansion to 300,000 tpy Copper and 700,000 tpy acid will reduce unit costs by approx. 25%.

Slide 37: Noranda Reactor
These advances in smelting of copper concentrate started with the development and commissioning of the first continuous smelting and converting process in 1973 called the Noranda reactor.

Slide 38: Noranda Converter
And continued with the development of Noranda Continuous Converter in 1997.

Slide 39: Noranda Converter
This converter increases our ability to handle impurities and reduces SO2 emissions.

Slide 40: New Madrid Primary Aluminum Facility
Noranda is not only a base metal producer. We have and continue to make substantial investments in Light Metals. Our primary aluminum reduction plant is located on the Mississippi River in the state of Missouri. It produces about 220,000 tonnes of primary aluminum per year, about 5% of the total US production. The facility is presently undergoing a modernization and conversion to single piece anode technology. The modernization will increase capacity by 15% to 250,000 tonnes per year and reduce costs by about 8% as well as improve environmental performance. This new capacity is being brought on at about ½ the cost of that of a Greenfield project (Greenfield at ~$3,500/mt).

Slide 41: Huntington Aluminum Foil Plant
Our aluminum fabricating operations consist of three plants in the southeastern United States. This one is the Huntington, Tennessee. Noranda is currently the 2nd largest producer of aluminum foil in North America and is amongst the lowest cost producers.

Slide 42: Aluminum Foil
We are currently expanding our foil capacity by 200 mm lbs. over 5 years to reinforce our position as the leading, low cost supplier of heavy gauge foil for:

- domestic and commercial building heat exchangers;

- automotive radiator fin stock; and
- semi-rigid food containers.

This expansion uses proven, state-of-the-art casting technology from France, rolling and product handling technology from Germany. Our challenge is to integrate these technologies. Cost savings are expected from:

- improved product quality;
- lower scrap rates from ability to roll wider widths; and
- faster cooling and lower handling damage from automated storage and retrieval.

Slide 43: Magnesium Plant

Our magnesium project is our most innovative and exciting project that we have. This plant is being built in Asbestos, Quebec and will have an initial capacity of 63,000 tonnes per year. We started construction in April of last year and expect production to begin in 2000. The raw material is serpentine tailings and it is above ground and adjacent to the operation. Currently we have a 300-year supply locked up and we are in a position to secure up to 1,000-year supply.

Slide 44: Magnesium Plant

The Project cost is C$733 million and will return a 12% ROI.

Slide 45: Magnola Flowsheet

The production process is based on proprietary technology developed over the last ten years by our Technology Centre. The Magnola process produces magnesium metal using serpentine tailings as the raw material source. These mining residues, containing up to 24 wt.% Mg, have accumulated over decades of mining the serpentine ore for asbestos fibers. The process is a chloride-based process using HCl as a leachant. The resulting high purity brine is then partially dehydrated in a fluidized bed spray dryer to produce $mgcl_2$ X H_2O prills. These prills are then fed to a melt chlorinator which uses HCl gas to further eliminate water and reduces the MgO content to less than 0.1% by wt. The anhydrous $MgCl_{2\,melt}$ is subsequently fed to an Alcan multi-polar cell to produce Mg metal currently operated by Sumitomo in Osaka. The HCl from the chlorinator is recycled to the leach. The Cl_2 from the cell is recycled as HCl gas to the melt chlorinator. The plant will produce pure and alloy products for aluminum alloying, die-casting, desulphurization and other applications.

Slide 46: Magnesium Refinery

A number of characteristics of our project lead us to believe that we will be the lowest cost producer when operating. As I mentioned our raw material is adjacent to the plant and above ground. This combined with our proprietary technology for processing the tailings gives us a competitive cost advantage.

Slide 47: Summary

To summarize – Noranda is a focused mining and metals company with a crystal clear target of achieving a 12% return on equity. Our road map to get there is direct and firmly in place. It consists of:

- our Margin Improvement Program - which is already surpassing our expectations; and
- redeploying our asset sale proceeds at rates of return at 12% or better.

I've detailed some of the projects in which we are investing which are world-class, high quality, sound initiatives. I believe that this two-pronged approach leads us on a path to deliver value to our shareholders and that technology has, and will continue to play a vital role in Noranda's future.

Slide 48 Logo

noranda

NORANDA
GROWTH THROUGH TECHNOLOGY

February 1999

NORANDA:

Over 75 Years of History

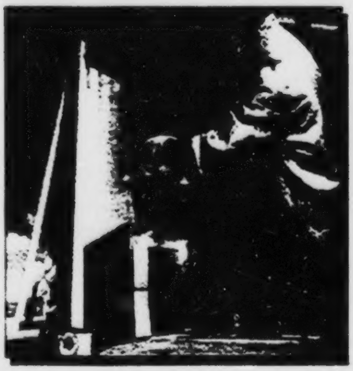
75th anniversary

Strategic Changes

- Focus on mining and metallurgy
- Sold Norcen investment
- Distributed Canadian Hunter and Noranda Forest shares

NORANDA:

A Mining & Metals Company

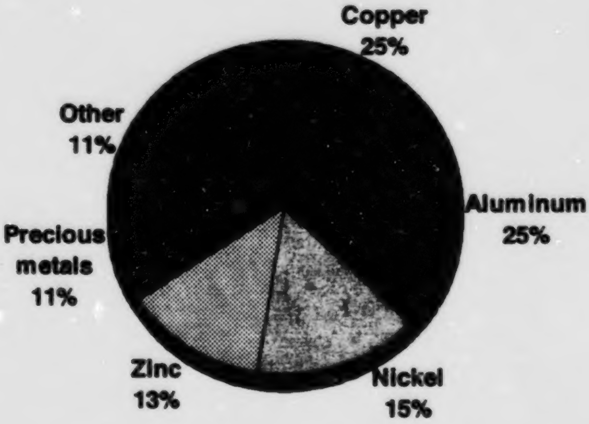


- Operate 23 mines, 16 metallurgical plants and 11 fabricating facilities
- Total assets of Cdn. $11 billion
- Total employees 21,000

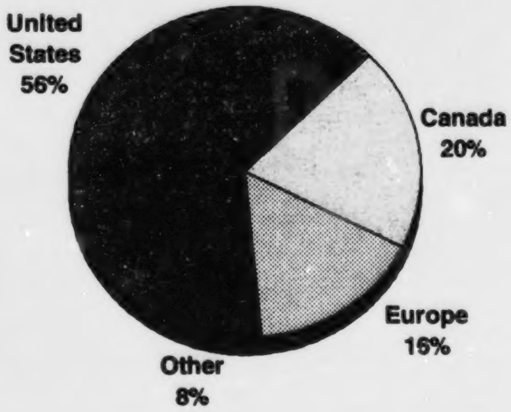
NORANDA TODAY

- Noranda Mines (Copper/Zinc); Metallurgical Plants (Copper/Zinc); Recycle (Precious Metals / Copper / Computer Components)
- Noranda Aluminum (Smelting / Fabricating-Ingot, Foil, American Racing Wheels)
- Falconbridge (50% Noranda; Nickel / Cobalt / Copper / Zinc)
- Battle Mountain Gold (28% Noranda; Gold)
- Magnola (80% Noranda; Magnesium)

Product Revenue Mix



Geographical Revenue Source



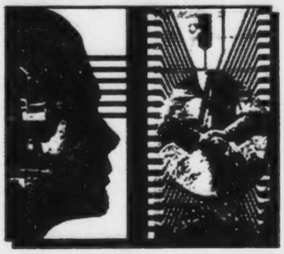
Our Objective

12% Return on Equity
Over a Full Commodity Price Cycle
Through:
-Profitable Growth
-Preferred Partner
-Performance Culture

Our Road Map

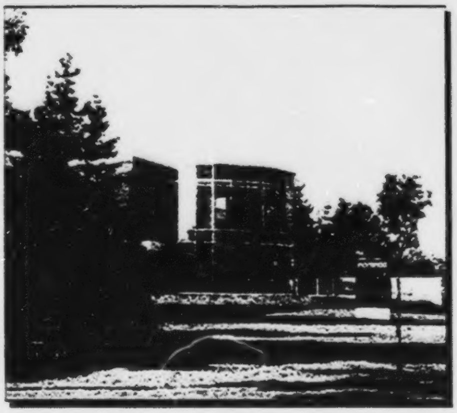
- ❒Margin Improvement Program
  - ❒$285 million per year pre-tax by year 2000
- ❒Redeploy proceeds from Norcen and other assets
  - ❒Invest some $4.5 billion in major projects

Noranda Technology



"Our ability to innovate, develop and implement technology is another critical ingredient for profitable growth.
This will give Noranda a boost in positioning ourselves among the world leaders in cost, be efficiency and environmental stewardship"
-David Kerr, President and CEO, Noranda Inc.

THE TECHNOLOGY CENTRE



- 164,000 sq..ft total
- Offices/library: 36,764
- Pilot Plant: 28,614
- Total labs: 26,348
- Conference centre: 11,933
- Noranda wide investment
  - Technology $62 million
  - Exploration $89 million

Margin Improvement Program
Progress to Date

❑Over 300 projects identified

❑Approx. $60 million improvement realized to date

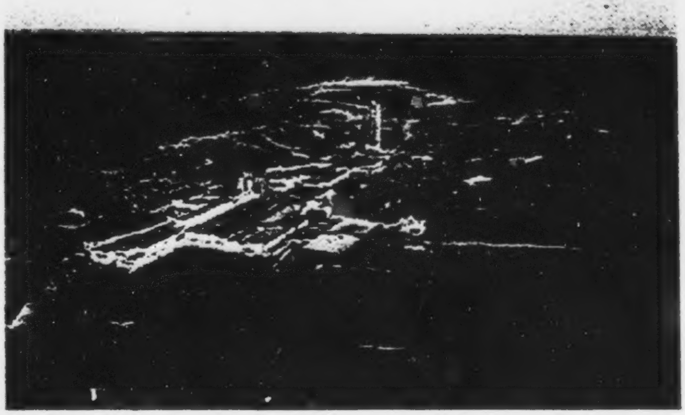
❑On track to $285 million target

MARGIN IMPROVEMENT PROJECTS

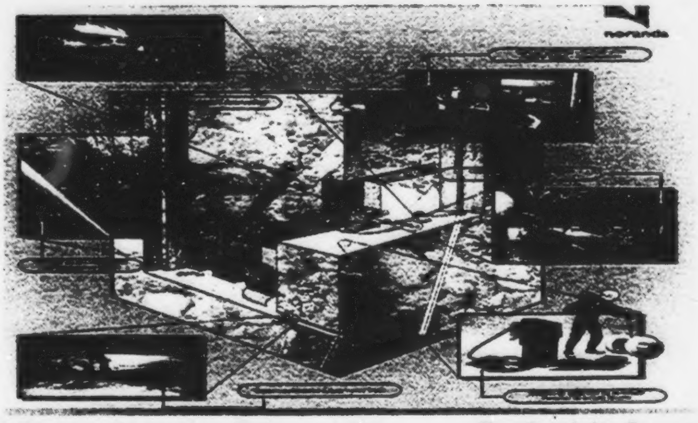
- Mine Production
  - Mine Automation
  - Dilution
  - Safety
- Metallurgical Production
  - Zinc Processing and Jarofix
- Fabricating
  - Zinc Battery Powder

MINE AUTOMATION

Brunswick Zinc Mine
(Canada)



Mine Automation



3 Scoops Operating Teleoperation
1 Truck Operating Autoguidance
Telecommunication

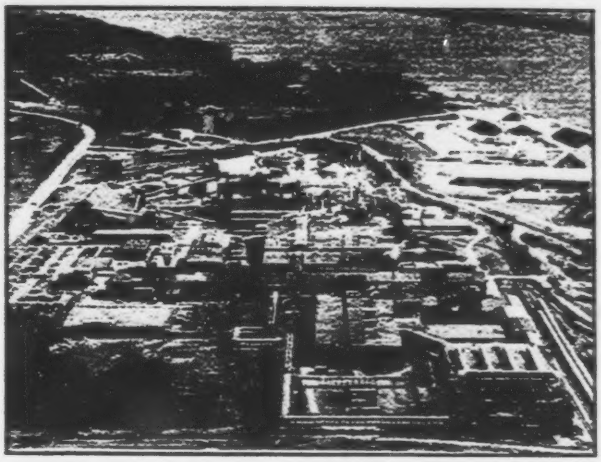
Productivity Increase
10% per Machine

Weasel

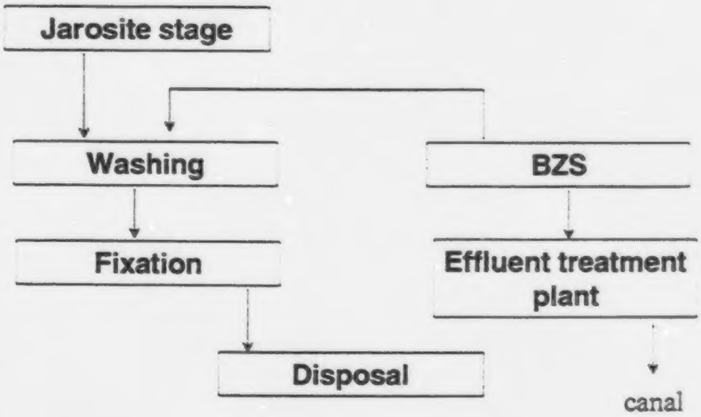
Cavity Monitoring System

Underground mining
Fully automated 3D system
Over 80 systems worldwide
3D Laser instrument placed at a boom end and used for underground stope dimensioning

CEZinc Refinery (Canada)



JAROFIX PROCESS



Jarosite stage

Washing

BZS

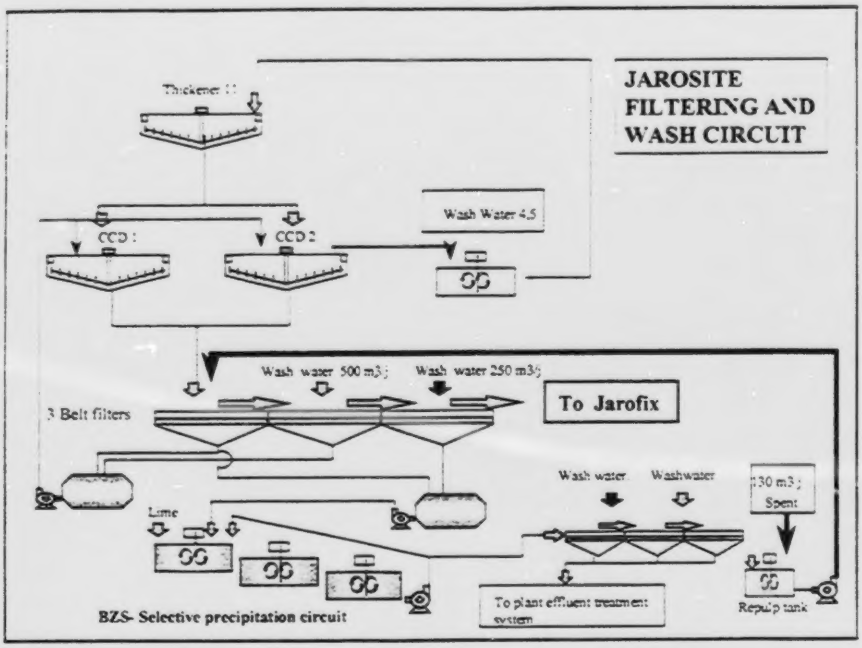
Fixation

Effluent treatment plant

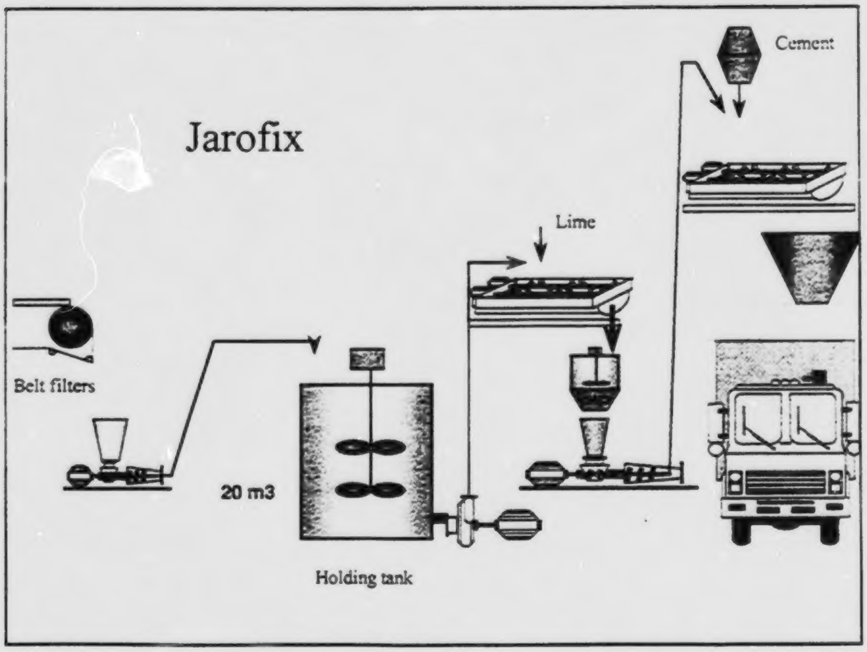
Disposal

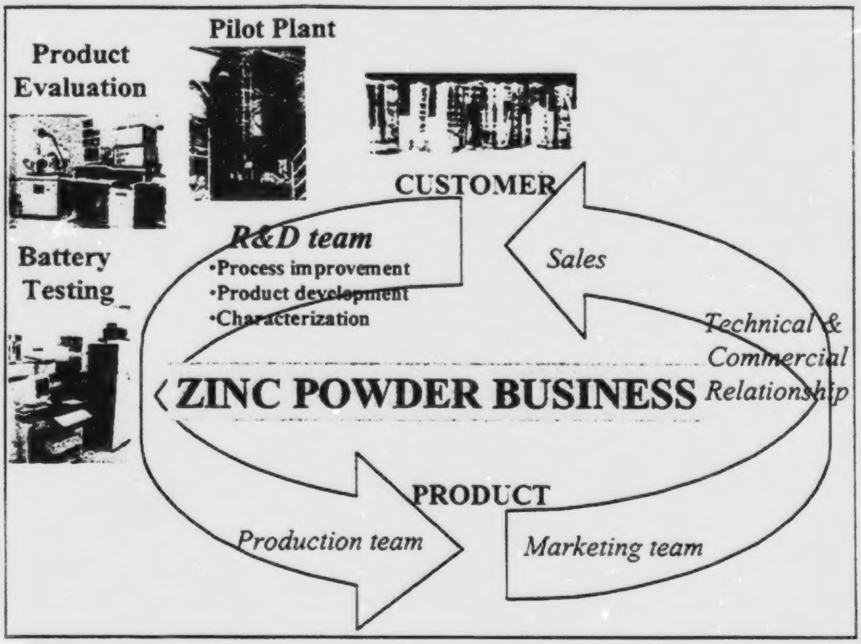
canal

JAROSITE FILTERING AND WASH CIRCUIT


Thickener 11
CCD 1
CCD 2
Wash Water 4.5
Wash water 500 m3/j
Wash water 250 m3/j
3 Belt filters
To Jarofix
Wash water
Washwater
130 m3/j
Spent
Lime
To plant effluent treatment system
Repulp tank
BZS- Selective precipitation circuit

Jarofix


Cement
Lime
Belt filters
20 m3
Holding tank



Product Evaluation

Pilot Plant

Battery Testing

CUSTOMER

R&D team

- **Process improvement**
- **Product development**
- **Characterization**

Sales

Technical & Commercial Relationship

ZINC POWDER BUSINESS

PRODUCT

Production team

Marketing team

Our Road Map

- ☐ **Margin Improvement Program**
- ☐ **Redeploy proceeds from Norcen and other assets**

Growth Initiatives

- Mine Production
  - Copper 100% '99
  - Zinc 17% '02
  - Nickel 20% '99
- Metallurgical Production
  - Copper 16% '00
  - Zinc 11% '99
  - Nickel 11% '99
- Light Metal Production
  - Primary 15% '01
  - Foil 75% '05
  - Magnesium Startup '00

Redeploying Asset Sale Proceeds

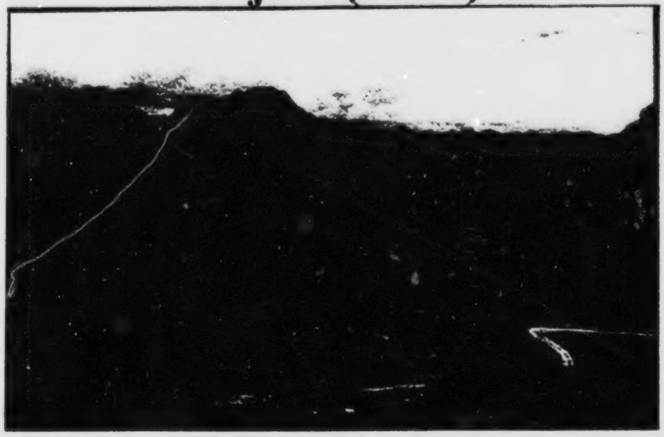
Projects	Beneficial Share of Cost $ Millions
Antamina Cu/Zn Mine	1,000
Altonorte Cu Smelter	500
Magnesium Refinery	600
Collahuasi Cu Mine	1,100
Raglan Ni Mine	600
Aluminum Foil	240
Other expansions	460
Total	4,500

GROWTH TECHNOLOGY

- Mining
  - Plasma Blasting
  - Virtual Mining
- Smelting and Converting
  - Altonorte Copper Smelter
  - SO2 Abatement and Recycle
- Light Metals
  - Primary and Foil Expansion
  - Magnola

Collahuasi Copper Mine (Chile)

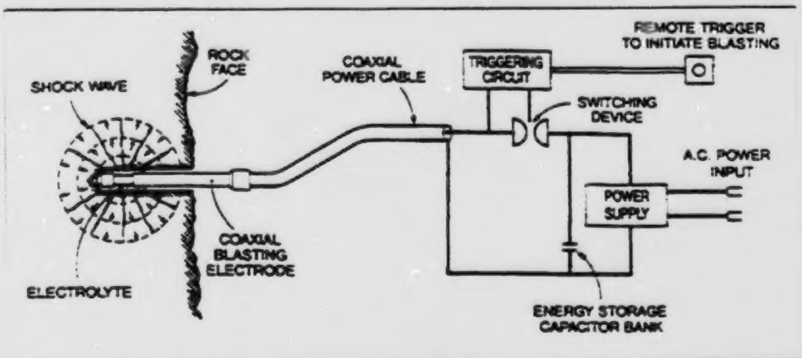
Antamina Copper/Zinc Mine Project (Peru)



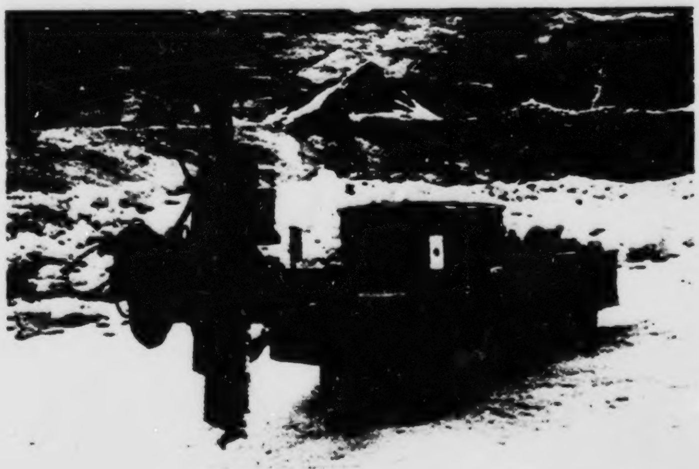
GENERAL MINING

PBT TECHNOLOGY VIRTUAL MINING

PLASMA BLASTING TECHNOLOGY


SHOCK WAVE
ROCK FACE
COAXIAL POWER CABLE
TRIGGERING CIRCUIT
REMOTE TRIGGER TO INITIATE BLASTING
SWITCHING DEVICE
A.C. POWER INPUT
POWER SUPPLY
COAXIAL BLASTING ELECTRODE
ELECTROLYTE
ENERGY STORAGE CAPACITOR BANK

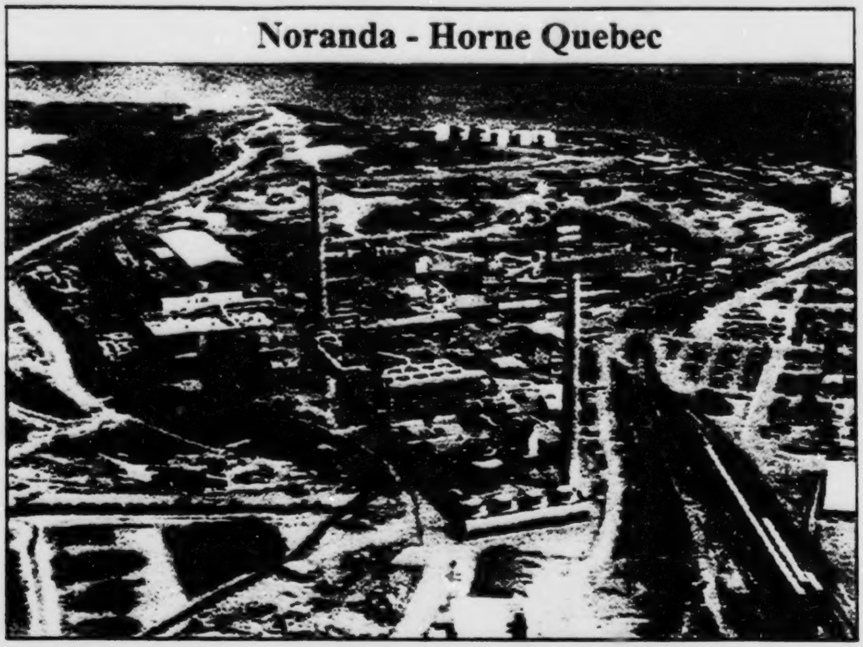
PBT PROTOTYPE



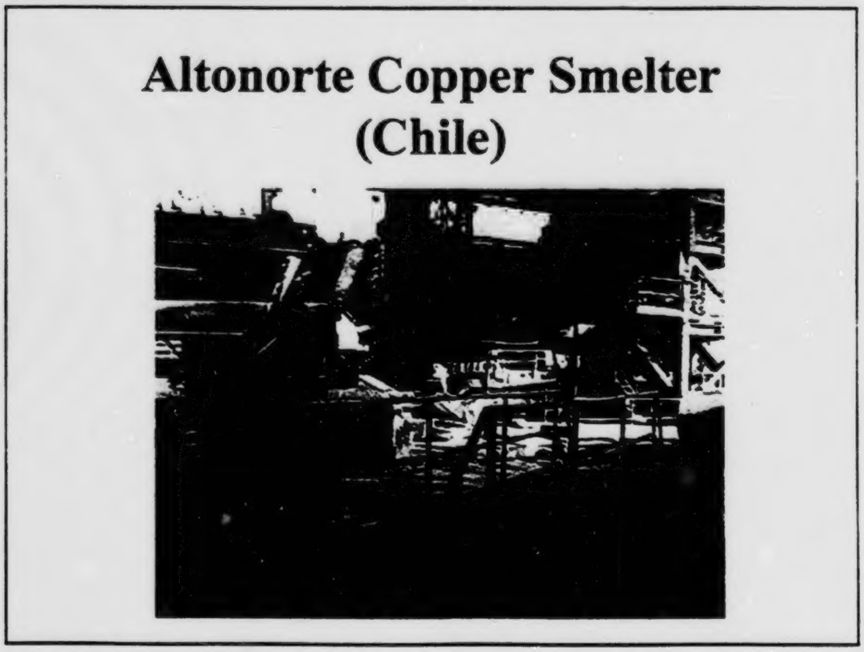
Virtual Mining

SMELTING TECHNOLOGY

NORANDA CONVERTER
&
NORANDA REACTOR

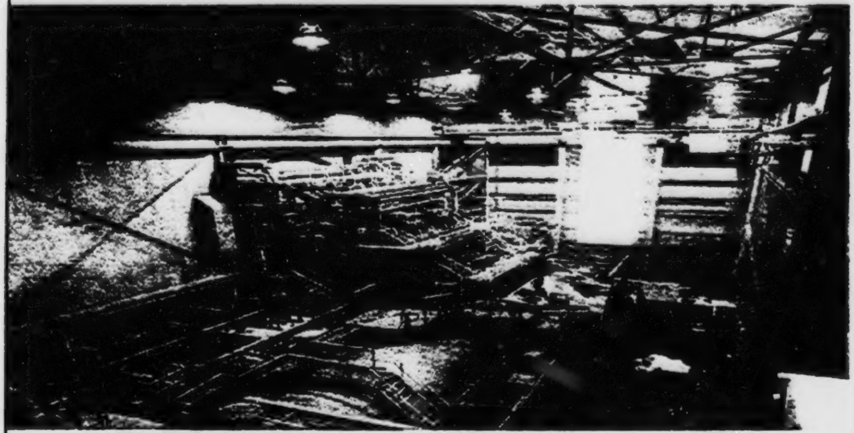


Noranda - Horne Quebec



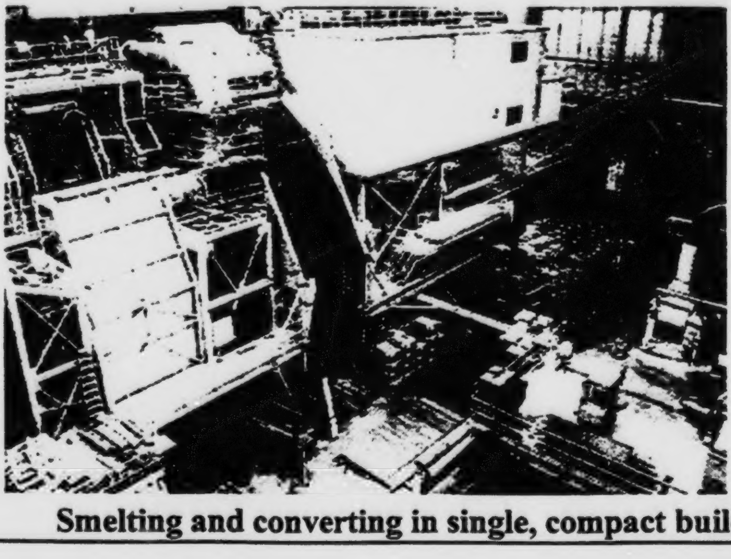
Altonorte Copper Smelter (Chile)

The Noranda Process Commissioned



World first continuous smelting and converting process–1973

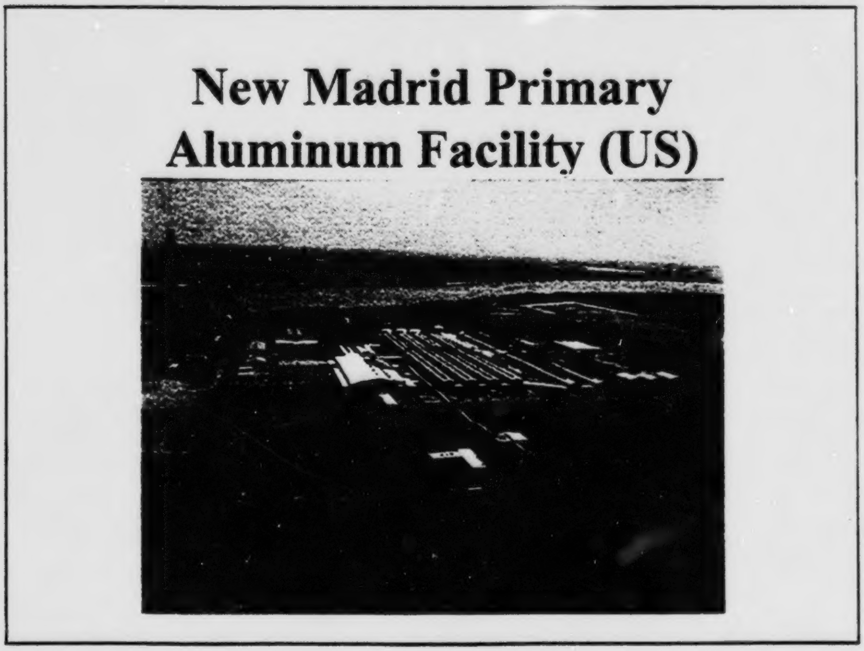
Noranda Continuous Converter (1997)



Smelting and converting in single, compact building

Noranda Continuous Converter (1997)

Simplicity in metal transfers



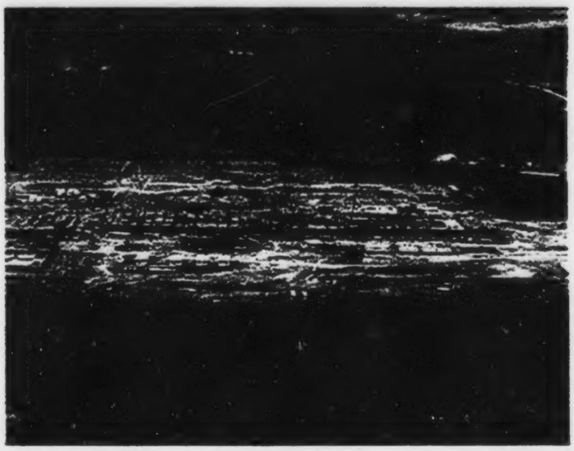
New Madrid Primary Aluminum Facility (US)

Huntingdon Aluminum Foil Plant (USA)

ALUMINUM FOIL

- **75% to 215,000 tpy by 2005**
- **Integration of:**
  - **Continuous Casting**
  - **Rolling**
  - **Slitting**
  - **Automated Storage and Retrieval**

Magnesium Plant (Canada)



Magnesium Plant (Canada)

☐ Project cost CDN$733 million

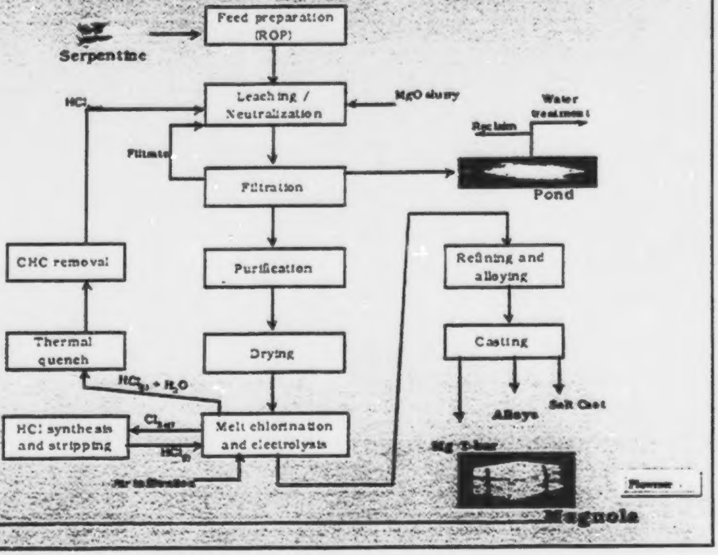
☐ 12% ROR

☐ Annual production of 63,000 tonnes/yr. Mg

☐ 300 year supply of serpentine tailings
@24% magnesium

☐ Startup in 2000

MAGNOLA PROCESS



Serpentine

Feed preparation (ROP)

HCl

Leaching / Neutralization

MgO slurry

Filtrate

Filtration

Reclaim

Water treatment

Pond

CHC removal

Purification

Refining and alloying

Thermal quench

Drying

Casting

$HCl_{(g)} + H_2O$

$Cl_{2(g)}$

HCl synthesis and stripping

$HCl_{(l)}$

Melt chlorination and electrolysis

Air infiltration

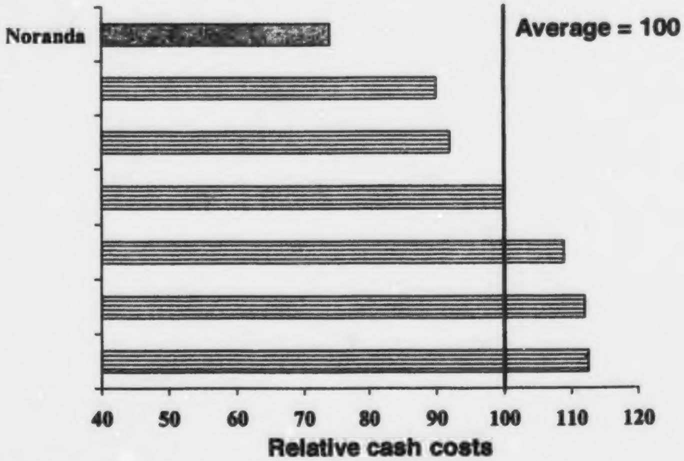
Alloys

Salt Cast

Mg T-bar

Magnola

Magnesium Refinery Competitive Position



IN SUMMARY

❐ **Focused mining and metals company**
❐ **Clear target of 12% Return on Equity**
❐ **Financial Strength**
❐ **Growth Initiatives**

Our ability to leverage our strong technological base is a key success factor for our company. It ensures that we will prevail as a preferred partner in the industry and will lead us to profitable growth.

noranda

Advanced Nickel Products at Inco Limited

Dr. Victor A. Ettel
Director, Product Research
Inco Technical Services Ltd.

CANADA: A WINDOW ON GLOBAL MINING
World-Class Technology and Investment Prospects
Canadian Embassy, Tokyo, Japan
February 17, 1999

Dr. Victor A. Ettel

Director, Product Research
Inco Technical Services

Victor A. Ettel earned his Dipl. Eng. in industrial chemistry and a Ph.D. in inorganic chemistry from the University of Chemical Technology in Prague, Czechoslovakia. He joined INCO's J. Roy Gordon Research Laboratory in 1968. Over the course of his career, he has published more than 50 technical papers and received patents on 47 inventions.

In his current position of Director, Product Research, Inco Technical Services Limited, he leads INCO's effort to develop value-added nickel products including specialized nickel powders, nickel foam and nickel hydroxide for use in consumer and electric vehicle nickel batteries. In this capacity, he works closely with the leading Japanese battery companies.

Canada – Exploration Expertise and Opportunities

Notes For a Presentation at
Canada: A Window on Global Mining Conference

February 17, 1999
Canadian Embassy
Tokyo, Japan

By

Deborah A. McCombe
President
Watts, Griffis and McOuat Limited
Toronto, Canada

Ms. Deborah McCombe
President,
Watts, Griffis and McOuat Limited

Mrs. McCombe is an economic geologist with over twenty years experience in the geological consulting and exploration industry, carrying out such projects as due diligence studies, ore reserve estimates and feasibility studies in North America, Africa, Asia and the Middle East. Ms. McCombe has also directed several large international projects, co-ordinating the efforts of numerous geologists and engineers.

A graduate of the University of Western Ontario, Mrs. McCombe is a Fellow of the Geological Association of Canada, a Member of the Canadian Institute of Mining and Metallurgy, Director of the Prospectors and Developers Association of Canada, a member of the Export Committee, Consulting Engineers of Ontario and an Ambassador for the Canadian mining industry.

Mrs. McCombe has had the privilege of addressing conventions in Southeast Asia and throughout Canada.

Canada – Exploration Expertise and Opportunities

For many years Canada has led the world in the development and use of advanced technology in the mining industry. From satellite surveying to the development of high tech safety, environmental and production equipment and practices, our mining professionals are competing by innovation and creating the tools of the future.

Right now, 85% of Canada's mining workforce uses advanced technology and telecommunications. Today's mine operators routinely work in the fields of robotics, satellite communications and computer systems. In fact, many of those employed in our mining industry are working at jobs that didn't even exist ten years ago.

Canadian mining companies spend more than $100 million a year on research and development. This has brought about world-leading technologies that have allowed us to increase efficiency; lower production costs, and dramatically improve mine safety and working conditions. For example, Noranda is currently developing a virtual reality mining helmet. It will allow operators at ground level to see in three dimensions and direct remote control equipment deep in the mine.

Geological exploration involves a high uncertainty factor and represents a significant portion of costs for mining companies. As well, the studies of geological environments often occur in insolated areas where access is difficult and expensive.

Canadian geophysicists have worked to develop specially equipped planes and helicopters to chart magnetic, electromagnetic and radiometric responses from the earth in the search of potential mineral finds. The use of satellites is common. Such developments have made Canadian explorers the most innovative and successful in the world.

High Sense Geophysics has a range of aircraft equipped with geophysical systems. Most of their systems operate in the semi-autonomous or automatic mode. The pilot turns the system on and flies the survey using the navigation screens to guide him. The flight lines are programmed in the computer and the equipment is self initiating and self testing. In fact, it is company policy that no one rides in the aircraft except the flight crew. Quality control, data processing and plotting are completed on a daily basis in the field.

The Navajo is a fixed wing vertical magnetic gradient system with an optional spectral gamma radiometric system. This system is a general purpose geological mapping tool and is used for high resolution aeromagnetic surveys for the petroleum industry.

The AHEM5 is a standard 5 frequency helicopter electromagnetic system containing five transmitter receiver coil pairs in various orientations. It is ideal for locating volcanogenic massive sulphide deposits and kimberlite as well as ground water mapping. It provides much higher resolution than fixed wing EM systems. The bird is typically flown at 30 metres off the ground with the helicopter at 60 m. The Global Positioning System is mounted in the bird so the positioning data is independent of the helicopter in relationship to the bird. A laser altimeter can be added to yield very accurate terrain clearance information. The laser data and the GPS vertical data can be used to create a pseudo-topography map. The huge data files collected in the air can be down loaded in the field and with High-Sense software can be processed and plotted within hours for immediate geological follow-up. High-Sense has specialized technology to map sea water depth, ice thickness and environmental contamination.

One of the most sophisticated exploration tools developed as part of the Canadian Space program is RadarSat. RadarSat is the world's first operational satellite with Synthetic Aperture Radar designed to produce images of the earth's surface regardless of weather conditions. It is much more sensitive than standard remote systems and its signals penetrate clouds as well as the earth's vegetation.

The return signals are interpreted as images with a resolution of just a few metres, which reveals important structural information such as folds and faults in the earth's surface. This characteristic is useful for the discovery of oil, gas and mineral deposits.

This is one of WGM's projects in Indonesia [Sibau Geology]. A strong NE lineament is shown along the centre of the basin. Multiple Sintang intrusions which may host mineralization occur at the intersection of NE & E trends. These present good exploration targets.

Satellites have also been effective in the area of telecommunication. Canada was the first country in the world to establish its own national satellite communications system in the early 1970s when the ANIK satellites were launched. As our own population was dispersed over a large geographic area, improved communications were a necessity. Satellite telephones are now a part of many exploration programs throughout the world.

Global Positioning Systems or GPS are used by exploration field crews and surveyors to determine their precise location in the dark, fog or dense jungle environments. This hand size computer records an exact position.

Once all the data is collected, it is compiled in a computer database. These databases are typically very large and may use a GIS system as a base, such as MapInfo or ArcView. A new development out of Australia uses one system to perform the correlation and prioritization of all data together, whether it be geological, geochemical or geophysical, to identify and rank possible anomalous areas for future investigation.

Much has changed since the early days of computers in mining. Many exploration companies are now using software such as that developed by Canadian-based Gemcom Software International Inc. Gemcom is the leading developer and supplier of specialized information technology to the exploration and mining industry. This Windows 95/NT software package is used to manage, analyze and display all types of mining and exploration data and is designed to take users from early exploration right through to mine planning, design and maintenance. WGM uses Gemcom for tasks ranging from the storage and manipulation of drillhole and sample data to 3-D orebody and block modelling. Gemcom systems are used by more than 700 companies in over 70 countries around the world. Gemcom has eight offices around the world which offer training and technical support in several languages.

Gemcom users can create realistic models of orebodies complete with topography to assist them in visualizing a potential mine or to guide future drill programs. The figure shows lithology, pit outline and a kimberlite pipe. Because Gemcom software is built in a Windows environment, any graphics/figures can be easily cut and pasted into other Windows programs. We have found that this is a great feature for preparing clients reports.

Environmental technology is another one of Canada's fastest growing economic sectors, with tremendous worldwide potential. The global market for environmental technology will approach $500 billion by the year 2000. Gemcom and Teck Corporation have formed a new environmental software products company. GemTeck Environmental Software now develops and markets EQWin, an environmental quality data management system. It is now an established management system in the North American mining industry for environmental data storage and reporting. It enables companies to monitor the effect of their operations on the environment and alerts users before potential environmental damage occurs.

The use of robotics is increasing at a fast past in the industry. INCO has been a leader in this area. In 1994, an INCO research miner made history by operating a remote control scoop tram at a convention in Toronto ... the scoop tram he was controlling was 350 km away at an INCO mine in Sudbury! The scoop tram operator was able to view the working environment in the mine as if he were underground, with absolutely no safety hazards to himself.

INCO is also using a remote controlled robot to position wire mesh in mine workings where rock falls pose a risk to miners' safety. Spar Aerospace and some of its partners developed the robot from Canadarm technology. The Canadarm is a remote manipulator system which has been used in over 50 successful space missions on American shuttles. Astronauts can recover and repair telecommunications satellites using the remote manipulator system.

Canada certainly has developed many of the tools to assist in the discovery of deposits or adapted pre-existing tools for use in the mining industry. However, exploration is an expensive endeavour and financing these programs is one of Canada's strongest capabilities.

"Toronto is the world's financial centre for the mining industry. The move to Toronto will place Boliden in close proximity to several of our important business relationships that are located in North America and our evolution into a public company will substantially improve our opportunities for growth and our ability to pursue financing opportunities". Anders Bulow, President, made these remarks when Boliden moved its head office to Toronto in 1997. And Boliden is not alone. Australian gold miner Normandy Mining listed on the Toronto and Montreal Stock Exchanges. Unlike Boliden, Normandy elected to retain its head office in Australia.

Other recent arrivals on the TSE include Getchell Gold, Meridian Gold, Philex Gold and TransHex International.

Over 300 mining firms are listed on the TSE, representing companies from Australasia to the Americas to Africa and Europe. Their combined market capitalization exceeds $80 billion.

In the financial sector, Credit Suisse First Boston established its international mining group in Toronto as did Deutsche Morgan Grenfell.

These recent arrivals joined a large group of mining companies, investment banks, consulting engineers, accountants, lawyers and other support people who have been in the city for some time. And why did these companies come to Canada and Toronto in particular?

The foundation for Toronto's position as an important financial centre evolved from the late 1800s and early 1900s. Silver was discovered in Cobalt, Ontario, nickel at Sudbury, Ontario and copper in Noranda, Quebec. These communities began to accumulate great wealth. Much of this wealth was reinvested in the mining business. In London, this lead to the establishment of mining finance houses which concentrated on mining investment in South Africa and Australia. In Canada and the USA, the wealth ended up in New York and Toronto.

With capital available and with excellent geology, a strong Canadian junior mining sector began to thrive. By the 1930s, Toronto had become an important financing centre and after the Second World War, the role of Toronto as an important financing centre accelerated, just as London's declined. The Canadian mining sector began to expand into international exploration and development activities in the late 1980s and Toronto's role as a financing centre also expanded. It is the ability to provide financing for junior mining companies that has been the foundation of Toronto's expertise.

The mining sector is very important to Canada - and to its stock exchanges. Shares of mining companies represent over 13% of the total capitalization of the TSE compared to about 1.5% for London and 1% of the NYSE.

In 1997, the TSE outranked all major exchanges for raising mining capital. Market liquidity, investor capital and industry expertise have attracted over 145 new mining and exploration companies to the TSE since 1992.

Toronto can be considered as Canada's largest mining town. Over 400 mining and exploration companies have offices in Toronto. Major companies such as Inco, Noranda, Falconbridge and Barrick Gold have head offices in Toronto.

Over 260 mining equipment suppliers, consulting firms and service providers are based in the Toronto area.

Toronto is undoubtedly the world's major centre for geophysical research and development. Supported by a strong program at the University of Toronto, firms like Scintrex, Phoenix, Geonics and Geoterrex-Dighem have thrived in the highly competitive atmosphere in the city. Consultants like Paterson, Grant & Watson, Aulak and High Sense Geophysics provide essential interpretation services.

Three certified assay laboratories have their headquarters in Toronto, while another four are located within a couple of hours drive away.

Metallurgical research laboratories such as Lakefield Research and ORTECH are located in the Toronto area, where we also find the private research facilities of both Inco and Falconbridge.

Major engineering companies include Kvaerner Davy, Kilborn-SNC Lavalin, Hatch and Canadian Bechtel.

One half of the mining analysts in the world probably work in Toronto.

Canada has the high tech tools for exploration, the mechanism for financing but most importantly in my mind, we have the exploration expertise to implement innovative and successful programs. And we find deposits... anywhere in the world.

One of our major strengths is the ability to build a competent Canadian exploration team. On proposals for international projects, a Canadian geophysical firm will link with Canadian geological consulting firm and even drilling firms to provide a unique approach to a project.

For example, Watts, Griffis and McOuat is currently working with the Geological Survey of Canada to provide technical assistance to the Geological Services Directorate in the Republic of Argentina. WGM is managing the Geophysical and Mineral Resource Mapping Program subcomponent of this World Bank funded project. Expertise in the fields of geological models, geophysics, geochemistry and map production are several of the areas in which we are transferring technology. The geophysical component consists of high resolution aeromagnetic surveying of five areas (150,000 km2) in remote, mountainous portion of southern Argentina. Four of these areas will also be surveyed with Gamma Ray Spectrometry.

WGM and Geological Survey of Canada geophysicists assisted the Argentinean Survey in the preparation of the tender document and assisted in the technical inspection of the geophysical survey operations. The airborne surveying contract was awarded to another Canadian-based firm, Sander Geophysics Limited. One of the products of the geophysical survey is a digital terrain model or "DTM". Since there is no detailed topographic map of the Tierra Del Fuego, the DTM will be a valuable product. The survey also outlined many intriguing magnetic anomalies along the coast and in the shallow water between Tierra Del Fuego and Isla de los Estados. Further investigation revealed that many were caused by the shipwrecks prevalent in the area.

We have also provided technical assistance in the area of mineral policy, mining regulations, geological mapping, compilation of country wide mineral deposits, the development of environmental policies to Geological Surveys in Saudi Arabia, Republic of Yemen, Ghana, Tanzania and Ecuador in recent years.

Canadian geological and engineering firms and individuals tend to establish long term relationships with their counterparts in other countries. Japan is a prime example of a long-term relationship. Since the early 1970's, Watts, Griffis and McOuat has implemented commodity studies for the Japanese External Trade Organization (Jetro), market studies for MMAJ and even some small early stage exploration investigations for Japanese firms.

Canadian geologists are known as mine finders because they follow a similar procedure in every new area which they investigate anywhere in the world. Initially prospecting is carried out to determine which area should be staked or acquired. A program of regional geological mapping, reconnaissance geochemical sampling and geophysical surveying identifies areas or anomalies that required more detailed sampling, mapping or surveying. Once all the data has been compiled, the most favourable targets are tested by drilling.

The best known recent Japanese - North American exploration success is the discovery of the Pogo gold deposit in east central Alaska. This project is one of the first large, multi year exploration programs in North America funded by a Japanese group, Sumitomo Metal Mining. This helicopter-supported exploration program was planned and implemented by WGM Inc., the Alaskan subsidiary of Watt, Griffis and McOuat.

To date, approximately 5.2 million ounces of gold at an average grade 0.52 oz per ton have been outlined by diamond drilling. Teck Corp has now taken a major role in the exploration and development of the Pogo property. Sumitomo is now investigating additional high priority targets on its land holdings surrounding the Pogo deposit. This exciting discovery has created a major staking rush in Alaska.

Canadians have vast experience in implementing exploration programs in remote areas, and in a variety of geological and social environments around the world. WGM has implemented projects in over 100 countries ranging from relatively shorter due diligence reviews to multi year institutional strengthening or project management contracts. Major mining companies, financial institutions, junior mining companies, governments, World Bank, and lawyers are some of our clients.

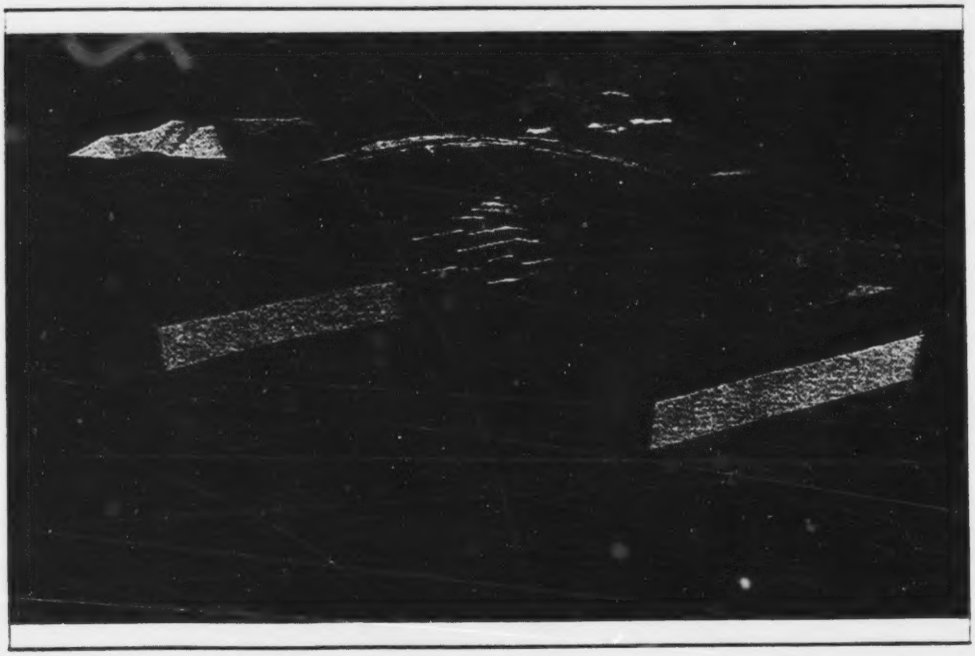
Watts, Griffis and McOuat has built relationships with Japanese firms and individuals for over thirty years and we look forward to continuing to work together in the future.

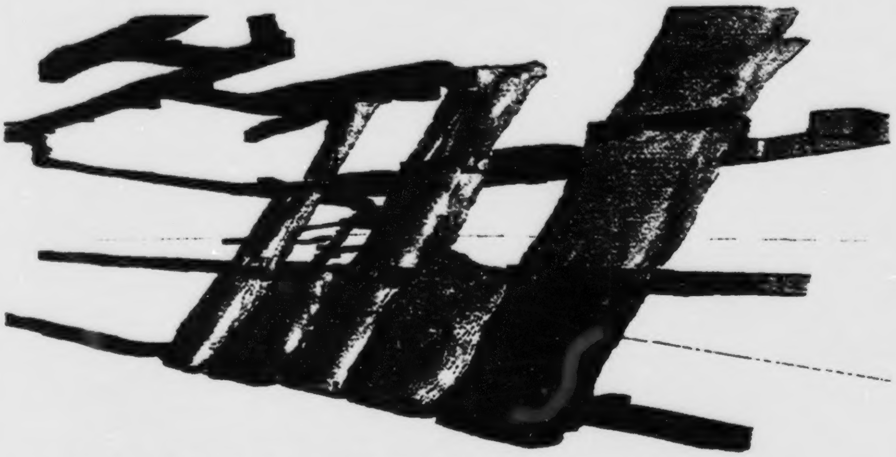
Canada - Exploration Expertise and Opportunities

By

Deborah A. McCombe

Watts, Griffis and McOuat





Triangulated Models of Underground Workings
(from survey data)

Watts, Griffis and McOuat

"Toronto is the financial centre for the mining world ...."

Anders Bulow, President
Boliden Limited

Watts, Griffis and McOuat

Bringing the World to Toronto

- Over 300 mining firms listed on the TSE, representing companies from Australasia to the Americas to Africa and Europe
- Combined market capitalization exceeding $80 billion

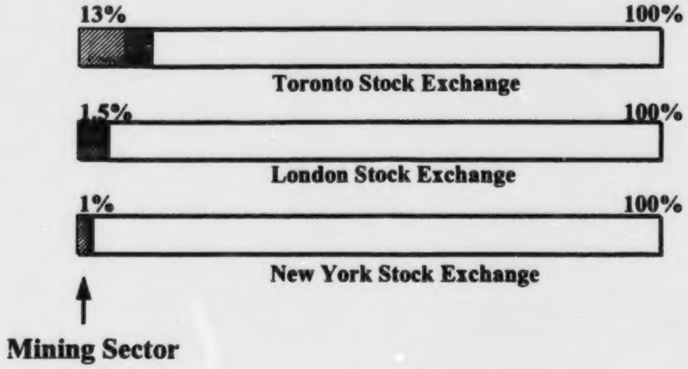
Watts, Griffis and McOuat

Toronto's Mining Finance Community

- **Investment Bankers**
- **Consulting Geologists and Engineers**
- **Geophysicists**
- **Assay Laboratories**
- **Metallurgical Research Facilities**
- **Major Engineering Firms**
- **Mining Analysts**
- **Equipment Manufacturers**
- **Accounting and Taxation Advisors**
- **Lawyers**

Watts, Griffis and McOuat

Market Capitalization



Mining and the TSE

- In 1997 the TSE outranked all major exchanges for raising mining capital
- Market liquidity, investor capital and industry expertise have attracted over 145 new mining and exploration companies to the TSE since 1992

Toronto - Canada's Largest Mining Town

- Over 400 mining and exploration company offices
- Over 30 mining head offices, including Inco, Noranda, Falconbridge and Barrick Gold
- Over 260 mining equipment suppliers, consultant firms and service providers

Watts, Griffis and McOuat

Mining Bay Street

- Investment firms operating mining sector divisions include CIBC Wood Gundy, Nesbitt Burns and RBC Dominion Securities
- Major independents such as First Marathon, Loewen Ondaatje McCutcheon, Yorkton, IBK Capital and C.M. Oliver also service the mining industry

Watts, Griffis and McOuat

Leading the World

- **Research**
- World class network of geoscience and environmental science researchers, including Scintrex, Phoenix and Geonics.
- Three certified assay laboratories
- Multi-million dollar Sheridan Park Research Centre, established through the support of Inco and Cominco

Watts, Griffis and McOuat

Environmental Technologies

Dr. George Poling
Senior Vice President
Rescan Environmental Services Ltd.

CANADA: A WINDOW ON GLOBAL MINING
World-Class Technology and Investment Prospects
Canadian Embassy, Tokyo, Japan
February 17, 1999

George W. Poling

Ph.D (Mineral Processing)
B.Sc. (Mining and Metallurgical Engineering)
Senior Vice President
Rescan Environmental Services Ltd.

Dr. Poling is Senior Vice President of Rescan, Professor Emeritus and former Head of the Department of Mining and Mineral Process Engineering at the University of British Columbia where he taught from 1968 onward and was Research coordinator for the B.C. Mining Association. He is one of Canada's leading experts in the environmental management of mining operations with special emphasis on effluent treatment, tailings disposal, waste solids handling, land reclamation and acid drainage control. Dr. Poling has been an associate consultant with Rescan Environmental Services Ltd. since its conception and serves as a member of the environmental monitoring review panel which oversees the monitoring program for BHP-Utah's Island Copper Mine on Vancouver Island. Dr. Poling has also been involved in research programs addressing acid drainage concerns and has published numerous papers on acid drainage control. Dr. Poling joined Rescan as Senior Vice President in August, 1997.

ENVIRONMENTAL TECHNOLOGIES

G.W. Poling
Senior Vice President, Rescan Environmental Services Ltd.
Vancouver, B.C. Canada

Abstract

Canada's mining, mineral processing and metallurgical engineers enjoy an enviable reputation as being among the world's best. Canadian achievements in mine-environmental protection are also recognized around the world. This paper will review several technologies currently used in: preventing or treating acidic mine drainages and, safely placing mine wastes at depth on the sea floor while minimizing environmental impacts. Protecting the extremely sensitive systems and communities at Canada's northern Ekati diamond mine will also be described. Rescan offers such expertise to the world wide mining community.

1.0 INTRODUCTION

Rescan Environmental Services is a consulting firm employing approximately 35 engineers and scientists who are engaged primarily in assisting mining companies all around the world in obtaining permits to operate and eventually close mines in environmentally responsible ways. Three case study examples are reviewed in this paper: (1) underwater tailing placement at Island Copper Mine, British Columbia, (2) use of a pit-lake as a near-passive treatment system for acid rock drainage and (3) protection of an extremely sensitive environment at Canada's first diamond mine "Ekati" in the Northwest Territories.

2.0 UNDERWATER TAILING PLACEMENT (UTP)

Placement of mill tailings underwater has been demonstrated to be one of the most effective ways of preventing atmospheric weathering reactions from generating metal-contaminated waste waters. Sometimes, for coastal mines, submarine tailing placement can be the best available technology to protect the environment. Figure 1 shows many coastal mine sites around the world where Rescan has been involved in the design and/or installation and monitoring. Some of these sites represent remediation works where "environmentally engineered" deep ocean disposal was employed to remove shoreline impacts of shallow discharges. Minimal requirements for subsea underwater tailing placement are that the tailings must be discharged below the euphotic (lighted) zone and stay there as stable sediment deposits on a low productivity sea bottom site and, the tailings must not leach potential toxins to the sea water column.

2.1 ISLAND COPPER MINE: Case Study of UTP

"Island Copper," whose location is shown on Figure 2, was the first large scale mine to use an engineered UTP system (in 1971) (1). Figure 3 shows part of the plant site with the two large (114 m dia) tailing thickeners from which the 20,000 - 60,000 tpd of copper-molybdenum flotation tailings flowed by gravity to a shore-located sea water mix tank (see Figure 4). A schematic of the mix tank and tailing discharge pipe at -50 m is shown in Figure 5. The mix tank deaerates the slurry and converts the aqueous phase to diluted sea water so that this carrier fluid will not possess buoyancy within the receiving sea water. This is to prevent any buoyant plume of fine tailings within the inlet. The primary goal of such a deep discharge is to prevent any tailing-derived turbidity from impacting photo-synthetic processess within the euphotic zone of the sea water column.

Figure 6 shows locations of initial marine monitoring stations established to monitor environmental impacts on the receiving water system.

2.1.1 Sub-sea tailing flow regimes:

Figure 7 shows pre-mine discharge bathymetry of Rupert Inlet/Holberg Inlet illustrating that these are both deep fjord-type inlets separated from the Pacific Ocean by a very shallow (~10 m) sill called the Quatsino Narrows. Figure 8 shows tailing sediment thicknesses on the floor of Rupert Inlet in January 1977, after approximately six years of continuous tailing discharge (2). At this stage the thickest deposits were 24 m deep and a meandering channel transport mechanism can readily be seen in the near field region down inlet. Figure 9 shows several high resolution sonographs of a leveed channel system transporting the tailing slurry down inlet as a somewhat coherent density current.

Periodically surges of density current were also detected down inlet. These apparently derived from slump failures of the steep walls of the levees. Further down Rupert Inlet the tailing density current fanned out to deposit in a near horizontal apron or fan pattern. Axial slopes of the channel and apron flow regimes of the tailing deposition can be determined from Figure 10. For the ICM tailing, which was ca 65% finer than 200 mesh or 74 μm, the upper reach decreased from the order of 9.5-12° near the outfall pipe to 1.9° at the first bend in Figure 9. In the middle reach the slope was nearly constant at 0.91° and again became nearly constant at 0.47° up to nearly 4.5 km from the outfall in the lower reach. Data such as these have been used around the world to mathematically model density current flow and depositional regimes. At mill closure (December 30, 1995) up to 137 m of tailing sediment had accumulated near the originally deepest point off Hankin Point.

Annual cycles of deep water renewal, controlled primarily by incoming jets of cold dense Pacific Ocean water flowing over the shallow sill at Quatsino Narrows infrequently resuspended tailings flowing at depth off Hankin Point. Plunging and upward rebouding currents sometimes up to 2 m/sec. infrequently upwelled tailings which redeposited on the northern flank of Rupert Inlet at Hankin Point. Such deep water renewal mechanisms are now known to be "common place" in silled fjords in British Columbia and Alaska. This upwelling was not predicted by the owners of ICM, however, and did raise significant concerns, particularly among Environment Canada regulators. As shown by 24 years of detailed monitoring data (and described in the following paragraphs) this infrequent upwelling did not impact adversely on the photosynthetic processes of the primary phytoplankton production in these inlet systems. There is no doubt, however that the Hankin Point upwelling and tidal currents spread fine tailings as sediment over a much wider area than originally predicted by the mine operators. Figure 11 shows the distribution of tailing sediments to 1994 which was near the end of the life of the mine.

Over 90% of the tailing solids are estimated to occupy the dashed-footprint of thick (>30 cm) deposits which corresponds very closely to the originally estimated (in 1970) footprint of 1600 acres. (3)

2.1.2 Chemical and Biological Monitoring

Figure 12 shows bar plots of 22 years of data on dissolved copper, manganese, zinc and arsenic in Rupert Inlet. Only manganese shows a small but statistically significant increase in concentration over this 22 year period. The slight increase in manganese level could have come from the ICM mining activity or it might have originated from soil erosion due to logging along the flanks of Rupert Inlet. No other statistically significant changes of dissolved metals occurred in the Rupert/Holberg inlet systems due to mine activities.

Figure 13 shows several depiction's of chlorophyll A concentrations, which are taken as a measure of phytoplankton abundance, in Rupert Inlet. These data in fact indicate a slight increase in the abundance of phytoplankton over the 22 year span. This increase is not likely due to tailing discharge influence but rather to increases in nearby human populations, fish farms, logging etc. in and around the shores of this inlet system.

Figure 14 provides data on crab catches. Both Rupert Inlet and Holberg Inlet supported very active commercial crab fishery both before and throughout the mine life and post closure. This fishery has continued to be healthy with periodic ups and downs due primarily to the impact of the fishery itself on crab populations. The mine tailings discharge has not impacted the crab fishery.

Monitoring of many different species living in Rupert/Holberg Inlets has shown that the mine tailings have not impacted on population densities or population diversities nor has there been any significant bio accumulation of heavy metals. The entire food chain from phytoplankton through zooplankton, through 4 metre long, six gill mud sharks, show no ill effects from nearly 25 years of discharging nearly 400 million tonnes of particulate solids to the floor of Rupert/Holberg Inlets. At present, even the benthos, have recolonized the thick tailing sediment deposits at approximately the same population density and at least as high a population diversity as existed on the inlet botoms, pre tailing placement.

2.1.3 Conclusions

Over the 28 year mine life and post closure period the Island Copper Mine was never cited for violations of their provincial tailing effluent or monitoring permits. Today few if any people now suggest that these tailings would have had lower environmental impact, had they been impounded on land. Thus Island Copper can be cited as a success story for submarine underwater tailing placement in spite of the unexpected and infrequent upwelling events off Hankin Point.

2.2 ISLAND COPPER MINE -
Near Passive Treatment of Acid Rock Drainage from On Land Waste Piles

After nearly eleven years of mining operations at ICM, some of the on-land waste rock piles adjacent to the large open pit began to show acidic rock drainage (ARD). During the rest of the operating life of the mine, such contaminated waters were collected in drainage ditches and discharged into a large capacity water management pond (WMP). This water was normally recycled to the flotation concentrator as process water. When this water met Provincial discharge criteria it was allowed to exfiltrate through the beach waste rock pile into Rupert Inlet.

Post closure, these contaminated waters have been discharged deep (200 m) into the pit made into a fresh water capped, sea water filled lake which is to act in perpetuity as an ARD treatment system.

Figure 15 shows a simplified cross section through the ultimate pit and the mostly submarine beach waste rock pile. An aerial view of the ultimate pit looking west is shown in Figure 16. To flood the pit with sea water, a channel was dug and ultimately a rock dam was blasted out to connect to Rupert Inlet through the pond shown in the top left corner of Figure 16. This resulted in a spectacular sea water waterfall lasting nearly a month in early summer 1996. At a level approximately 15 meters below overflow the sea water channel was sealed off and a fresh water cap filled to overflow level by late 1998 (see Figure 17). At that point, excess surface brackish water meeting all effluent permit requirements exfiltrates through the beach waste rock pile to Rupert Inlet. Figure 18 shows the chemically meromictic pit lake looking toward the west. The drainage-ditch collected, low grade ARD waters are discharged via ~1 m diameter polyethylene pipes from both the north and south flanks of this pit lake to a depth of ~210 m. The pit has an ultimate depth of ~350 m. The intermediate (-12+210 m) and bottom (-210 + 350 m) saline layers of this pit lake will eventually go anoxic. ARD injected into these regions will then precipitate out heavy metal contaminants as sulphide particulates due to the action of sulphate reducing bacteria (SRB) generating H_2S from the SO_4= rich ARD waters. Oxygen levels in the intermediate zone are already in the region of 3 mg/L (down from ~9 mg/L at pit flood). The saline intermediate layer is relatively well mixed but the fresh water cap serves to trap ARD derived metal contamination and anoxia below ~12 m so that the fresh water cap continues to meet discharge requirements. Attempts to accelerate anoxia include seeding the lake with fertilizer (fish wastes) to promote plankton blooms and oxygen consumption. Predictions indicate that within ~2 years the pit should begin to function as a near passive precipitation system due to the action of SRBs.

While this site has several unique features, other near-passive pit lake treatment systems for ARD might also be workable. Reclamation work such as that described above together with an extensive effort at land reclamation have earned Island Copper Mine the 1998 B.C. Technical of Research Committee - Reclamation Award.

3.0 ENVIRONMENTAL TECHNOLOGIES AT CANADA'S FIRST DIAMOND MINE - EKATI, NWT

Ekati Diamond Mine is located approximately 300 kilometers northwest of Yellowknife in the "barrenlands" above the northern limit of trees in Canada's Northwest Territories (see Figure 19). The land is considered a polar desert with total precipitation less than 400 mm per year. The ground is permanently frozen (permafrost) to a depth of 250 meters and holds snow cover for more than eight months per year. In each brief summer the land becomes carpeted with fragile plants that are sensitive to the slightest disturbance. In order to obtain permits to develop this mine, BHP employed Rescan to conduct two years of environmental baseline studies and assist in production of an eight volume Environmental Impact Statement (EIS) submitted to the Canadian Government in July 1995. Key issues were to minimize impacts on plants, mammals, birds, fish and their habitats and to achieve "impacts and benefits agreements" with four different groups of aboriginal peoples in the area: the Dogrib, the Chipewyan, the Metis and the Inuit.

Conditional approval was granted in August 1996 with final approval in January 1997. This involved development of a new Environmental Agreement and a Socio-Economic Agreement which ensured major benefits to northerners and particularly to the aboriginal peoples themselves. In addition to modern scientific studies, use was made of "traditional knowledge" emanating primarily from aboriginal heritage resources in plans for environmental protection measures. Care was also taken to protect significant archeological sites in the mining areas.

The minesite is accessible normally only by air or by a winter ice road (lasting two months each year) from Yellowknife over 300 kilometers to the south (see Figure 20). The diamonds are found at Ekati in kimberlite pipes, most of which lie under lakes gouged out by glaciers due to the softer nature of kimberlite than the granitoid country rock. Figure 21 shows the first pipe, "Panda" currently being mined for diamonds via conventional open pit mining technology. At least four other pipes are to be mined in the current 17 year mine life plan. Kimberlite ore is processed at ~9000 tonnes per day in the processing plant shown in the centre of Figure 22.

A section of Ekati diamonds in shown in Figure 23. These gem quality diamonds are finding a welcome market since start up of the mine in October 1998. Monitoring of mining impacts comprises more than 30 separate programs involving more than 25 people. These include BHP staff, environmental consultants such as Rescan, and aboriginal groups. Monitoring will continue throughout the life of this mine and beyond to ensure impacts are minimized. Environmental consultants must be highly sophisticated to adapt technologies to northern extremes of climate and plant, animal and soil sensitivities to serve companies such as BHP Diamonds and their northern population well.

4.0 SUMMARY

Rescan Environmental Services Ltd. meets highly diverse needs of a global mining industry to protect environments well while developing the earth's natural mineral resources. The three case studies reviewed above cover areas of subsea underwater tailings placement; acid rock drainage and extreme sensitivities of Canada's vast northlands. Our capabilities in environmental services extend well beyond these three examples and we invite your enquiries.

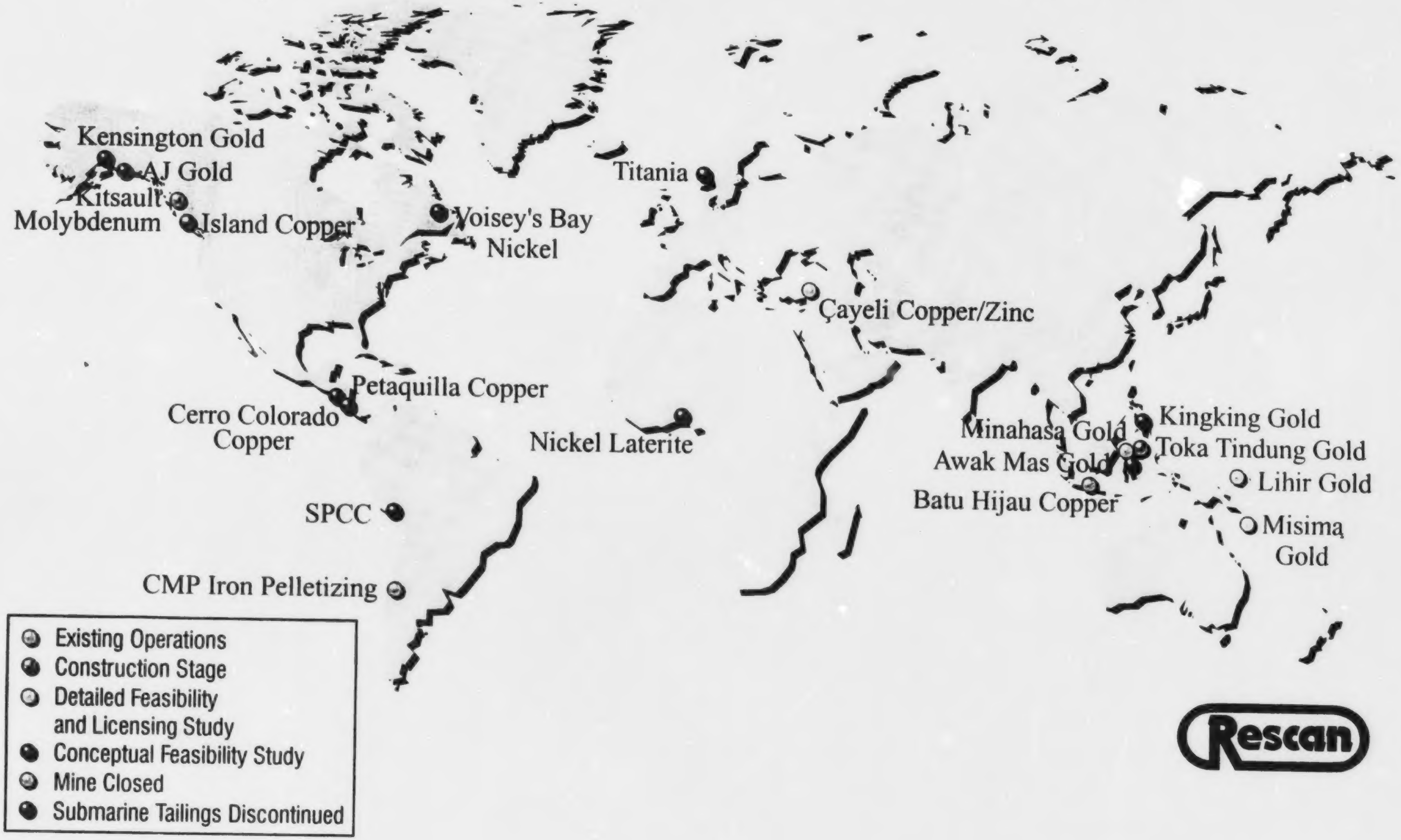
REFERENCES

(1) Ellis, D.V., Pedersen, T.F., Poling, G.W., Pelletier, C.A. and Horne, I., Review of 23 Years of STD: Island Copper Mine, Canada, Marine Georesources and Geotechnology, Vol. 13., pp. 59-00 (1995)

(2) Hay, A.E., The effects of submarine channels on mine tailing disposal in Rupert Inlet, Chp 5, p. 139-181, Marine Tailings Disposal, Ann Arbor Science Publ., (1982)

(3) Utah Construction and Mining Co. Brief in support of application for pollution permit October 2 (1969)

FIG.1 Rescan Submarine Placement Projects


Kensington Gold
AJ Gold
Kitsault Molybdenum
Island Copper
Voisey's Bay Nickel
Titania
Çayeli Copper/Zinc
Petaquilla Copper
Cerro Colorado Copper
Nickel Laterite
SPCC
CMP Iron Pelletizing
Minahasa Gold
Awak Mas Gold
Batu Hijau Copper
Kingking Gold
Toka Tindung Gold
Lihir Gold
Misima Gold
Existing Operations
Construction Stage
Detailed Feasibility and Licensing Study
Conceptual Feasibility Study
Mine Closed
Submarine Tailings Discontinued
Rescan

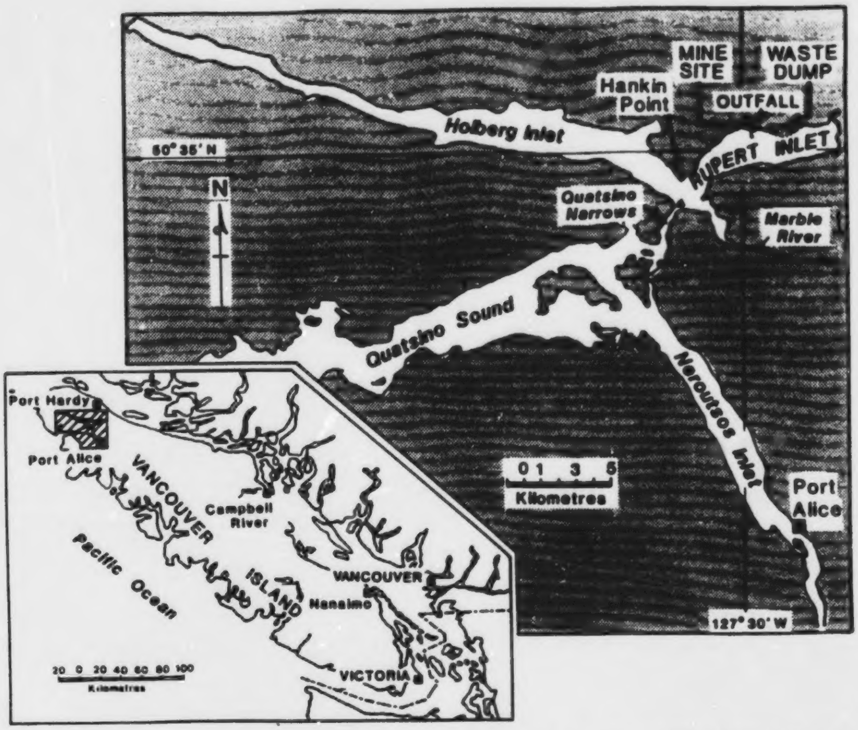

MINE SITE
WASTE DUMP
Hankin Point
OUTFALL
Holberg Inlet
50° 35' N
RUPERT INLET
N
Quatsino Narrows
Marble River
Quatsino Sound
Neroutsos Inlet
0 1 3 5
Kilometres
Port Alice
127° 30' W
Port Hardy
Port Alice
VANCOUVER ISLAND
Campbell River
Pacific Ocean
VANCOUVER
Nanaimo
VICTORIA
20 0 20 40 60 80 100
Kilometres

Figure 2. Location map showing Rupert Inlet and the mine site.

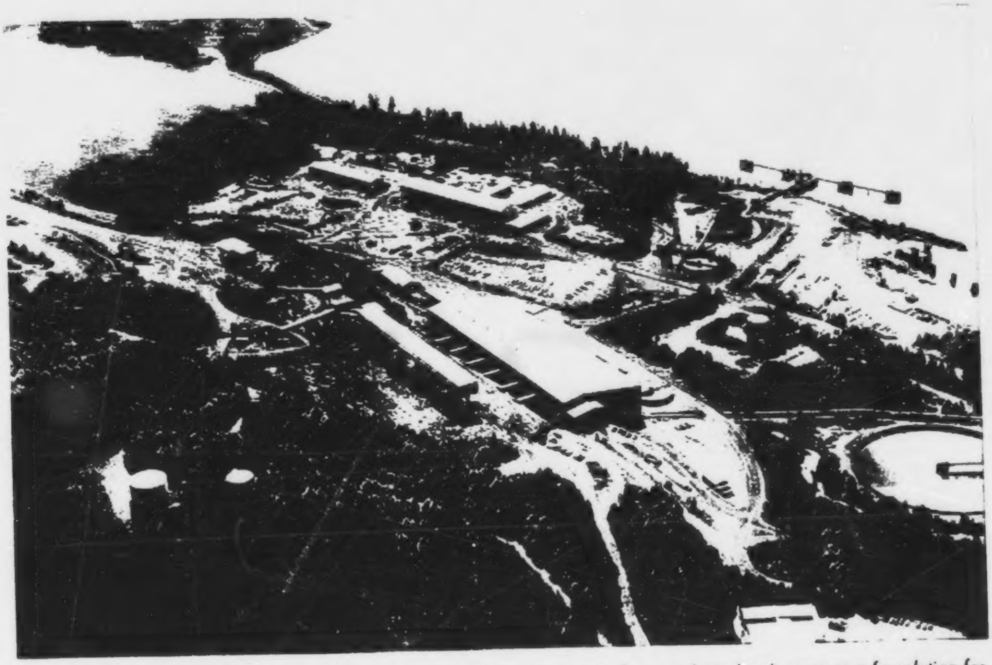


Fig. 3. *The Island Copper plant site in 1994. The knoll at top left is a waste rock dump replanted with grass as a foundation for alder and, eventually, evergreen trees. The knoll was a favorite feeding site for deer and Canada geese from the time it was planted.*

Figur 4 . Two STD outfalls at Island Copper Mine. The outfall on the left is currently operational. The tailings line descends underwater and discharges to the deaeration tank. This is accessed by a catwalk from the shore. The original outfall is to the right and is now a standby. The tailings line is within a catwalk and discharges from above into the deaeration tank. A band of intertidal biological growth shows up white around the lower part of both tanks.

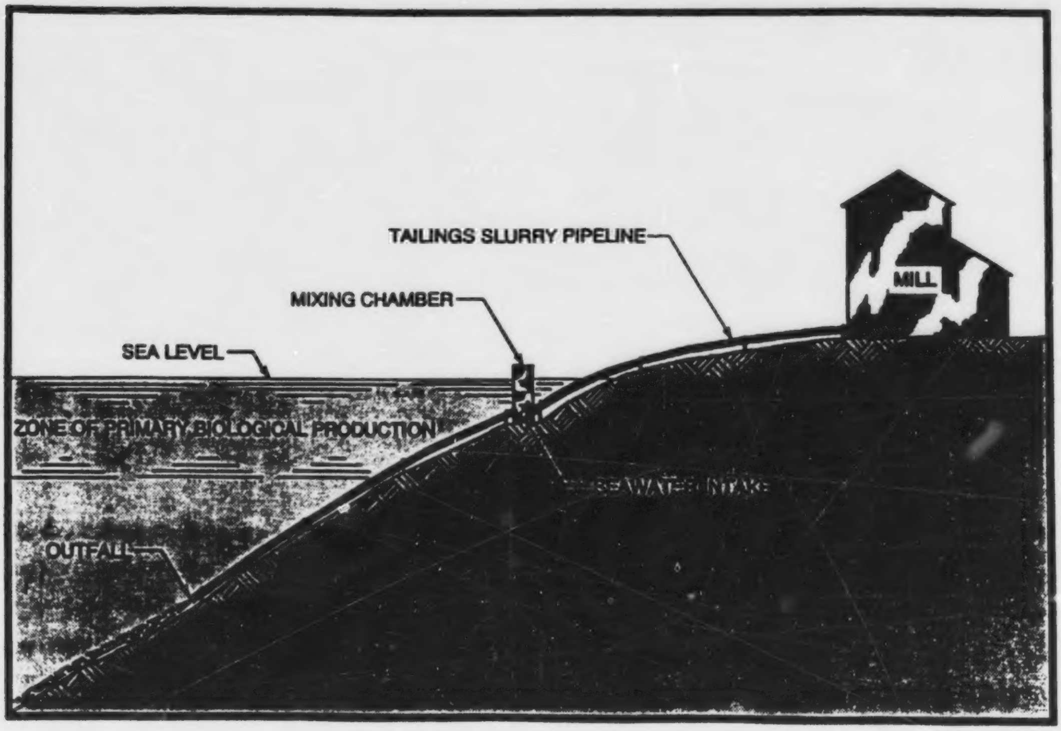
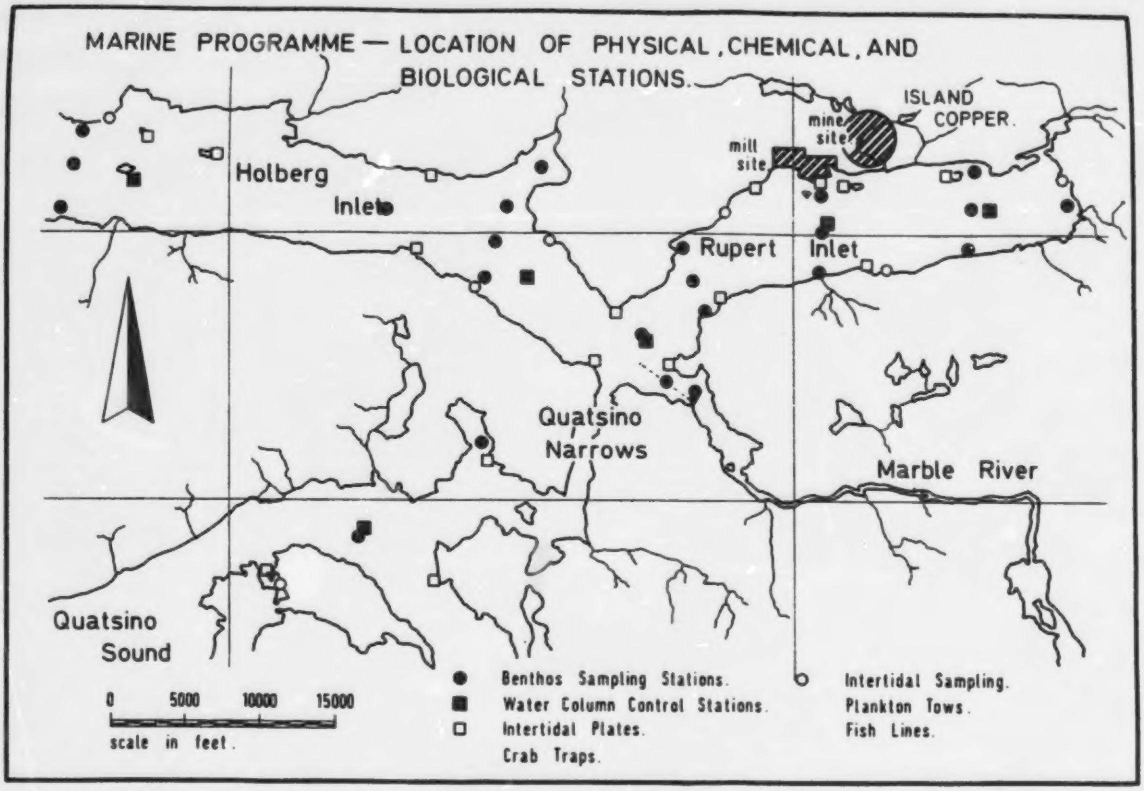

TAILINGS SLURRY PIPELINE
MILL
MIXING CHAMBER
SEA LEVEL
ZONE OF PRIMARY BIOLOGICAL PRODUCTION
SEAWATER INTAKE
OUTFALL

Figure 5 Schematic of STD system.


MARINE PROGRAMME — LOCATION OF PHYSICAL, CHEMICAL, AND BIOLOGICAL STATIONS.
ISLAND COPPER.
mine site
mill site
Holberg Inlet
Rupert Inlet
Quatsino Narrows
Marble River
Quatsino Sound
0 5000 10000 15000
scale in feet.
● Benthos Sampling Stations.
■ Water Column Control Stations.
□ Intertidal Plates.
Crab Traps.
○ Intertidal Sampling.
Plankton Tows.
Fish Lines.

Location of physical, chemical, and biological stations in Island Copper Mine's marine program in connection with discharge of mill tailing into Rupert Inlet, Vancouver Island.
Figure No. 6

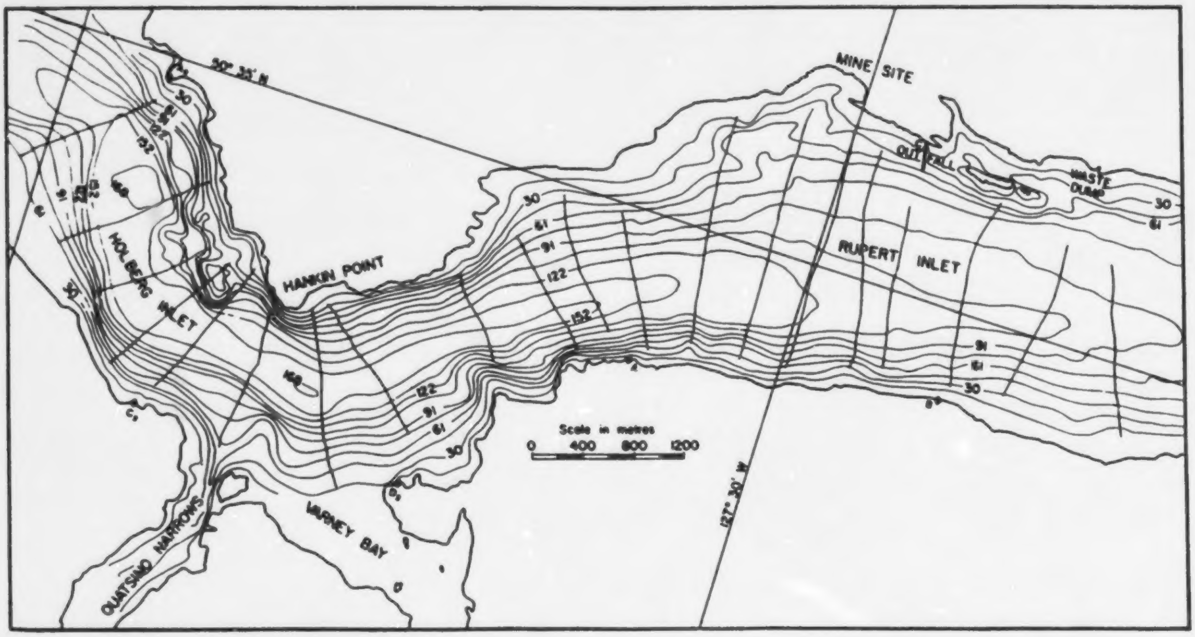

50° 35' N
MINE SITE
OUTFALL
WASTE DUMP
RUPERT INLET
HANKIN POINT
HOLBERG INLET
VARNEY BAY
QUATSINO NARROWS
Scale in metres
0 400 800 1200
127° 30' W
30
61
91
122
152
168

Fig. 7 Location map showing Rupert Inlet, the mine site and the pre-mine bathymetry. Depths in meters. The cross-inlet lines are the approximate locations of the CSP profiles.

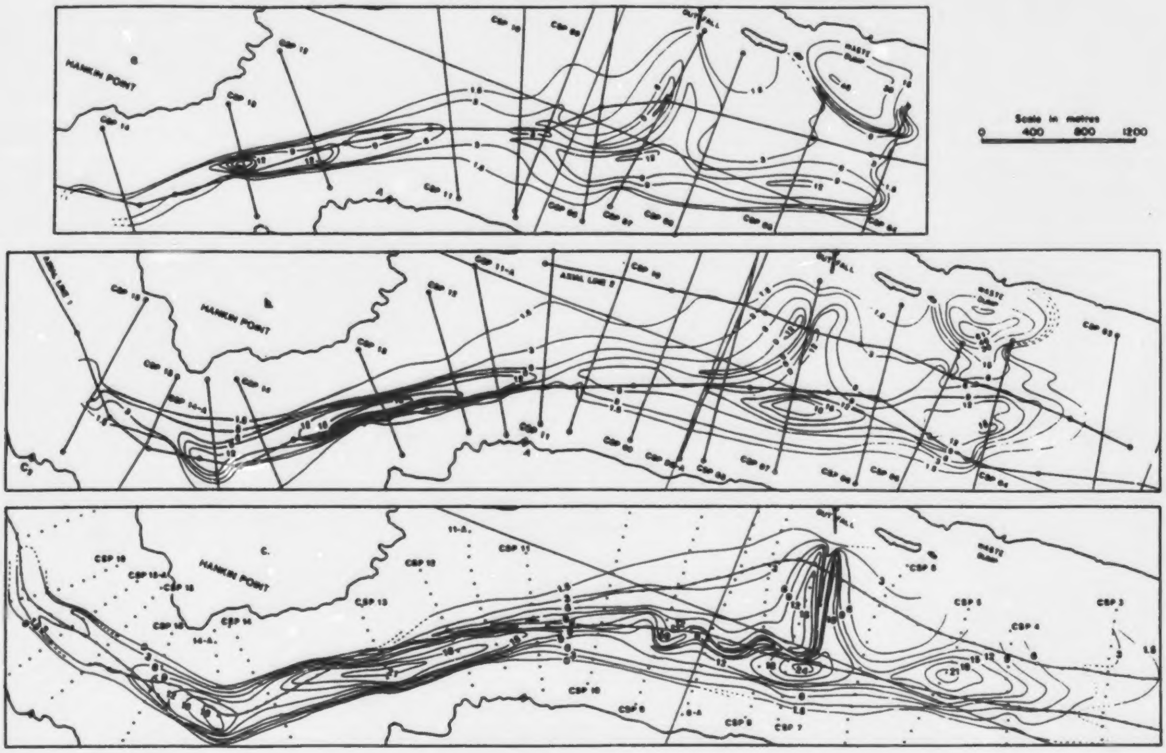

HANKIN POINT
OUTFALL
WASTE DUMP
Scale in metres
0
400
800
1200
a
b
c

Fig. 8 Tailing thickness in meters in: (a) November 1974; (b) October 1975; and (c) January 1977. Solid circles indicate position fixes.

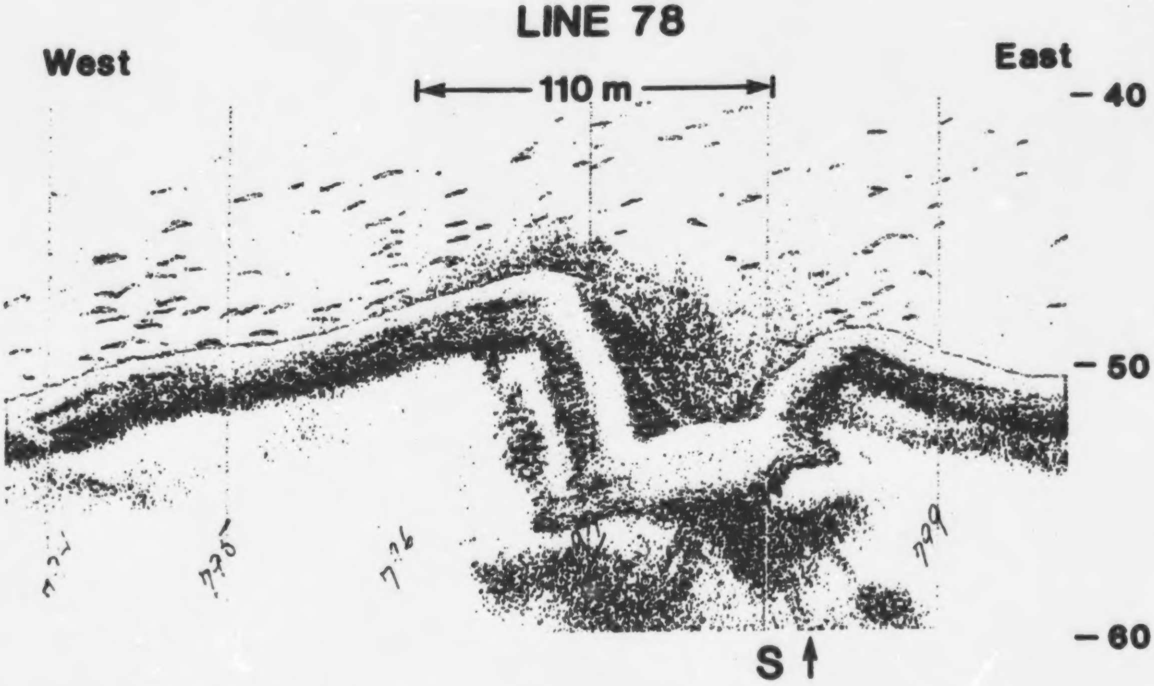


Figure 9. Sonograph of the channel and discharge plume. looking upstream, during flood tide 3.5 h after low water, 22 November 1976, 1050 h PST. S = side-echo, P = plume. Vertical lines indicate times of position fixes taken at 1 min intervals. Line location is 620 m off the outfall (Fig. 6).

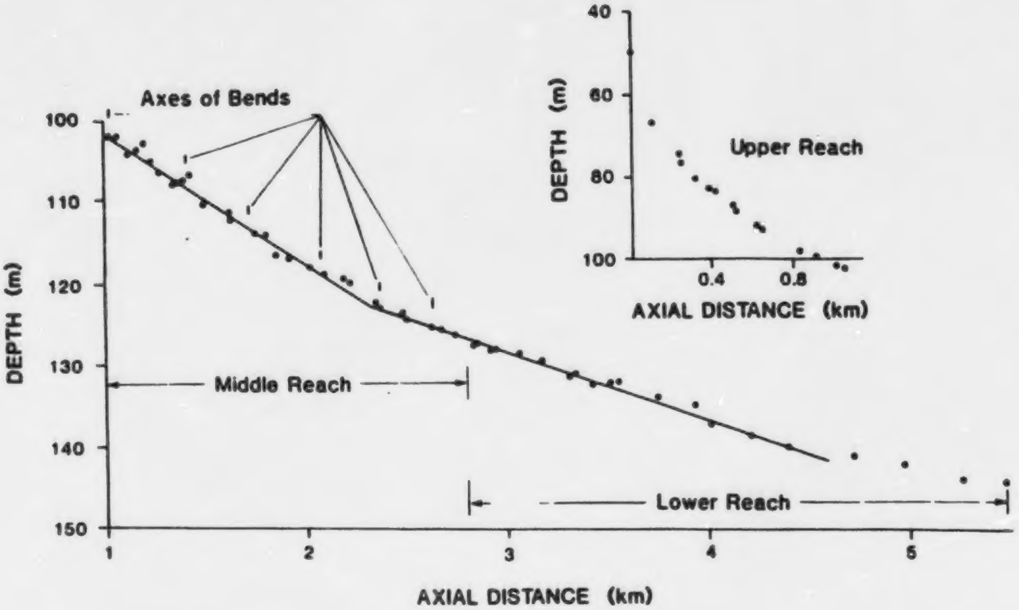


Fig.10. The depth of the November 1976 meandering channel axis as a function of axial distance from the outfall. The locations of each of the bend axes in the middle (meander) reach are shown. The solid lines are those from which the axial slopes were computed.

Island Copper Submarine Tailings Monitoring Program

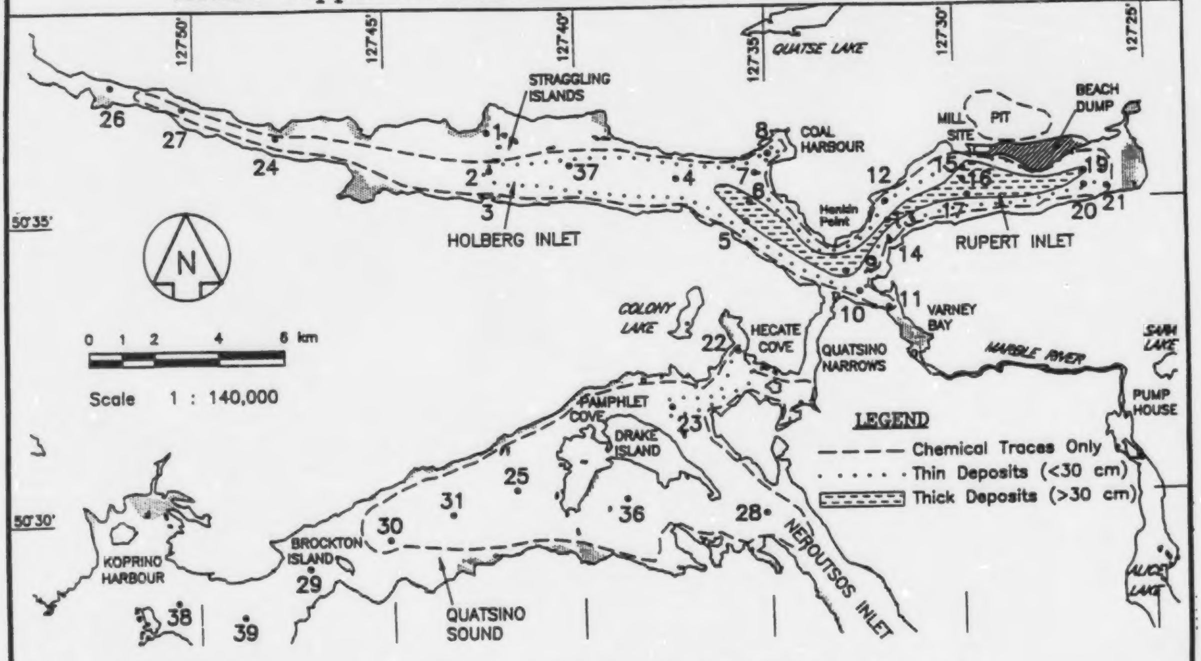

127°50'
127°45'
127°40'
127°35'
127°30'
127°25'
QUATSE LAKE
STRAGGLING ISLANDS
COAL HARBOUR
MILL SITE
PIT
BEACH DUMP
HOLBERG INLET
RUPERT INLET
Henkin Point
50°35'
50°30'
COLONY LAKE
HECATE COVE
QUATSINO NARROWS
VARNEY BAY
MARBLE RIVER
SUSH LAKE
PUMP HOUSE
PAMPHLET COVE
DRAKE ISLAND
KOPRINO HARBOUR
BROCKTON ISLAND
QUATSINO SOUND
NEROUTSOS INLET
ALICE LAKE
N
0 1 2 4 6 km
Scale 1 : 140,000
LEGEND
Chemical Traces Only
Thin Deposits (<30 cm)
Thick Deposits (>30 cm)
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
19
20
21
22
23
24
25
26
27
28
29
30
31
36
37
38
39

Figure 11. : Tailings Distribution to 1994

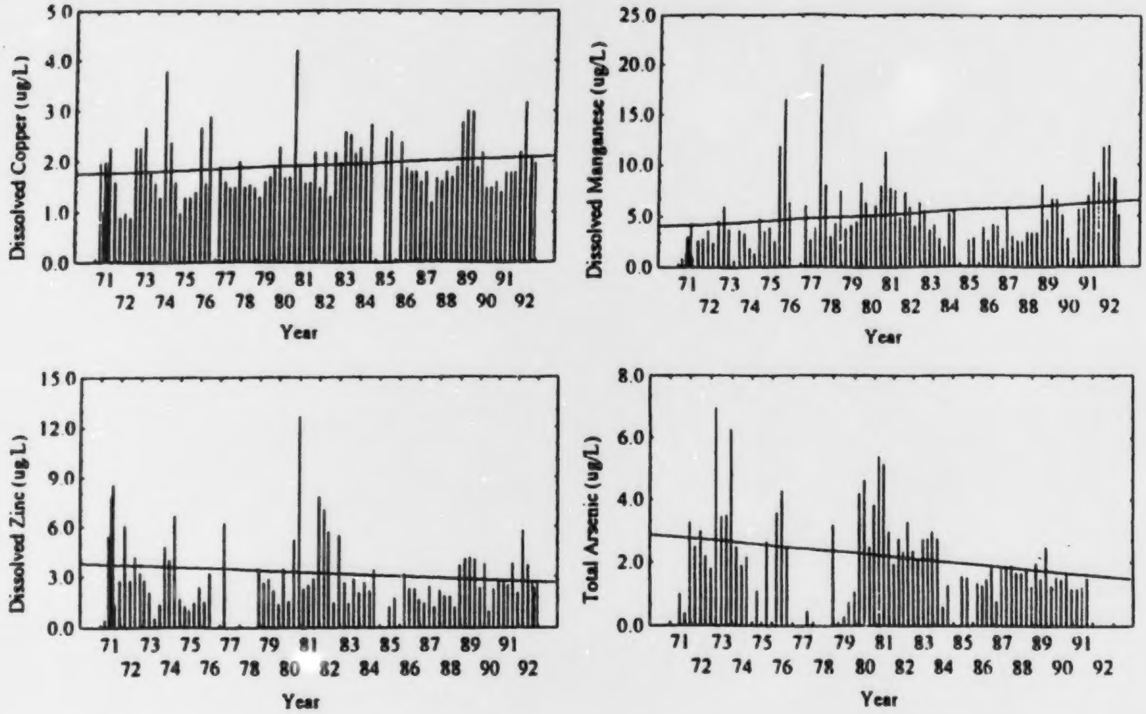


Figure 12. The bar plot with linear fit for dissolved copper, dissolved manganese, dissolved zinc, and total arsenic observed at station A from 1971 to 1992.

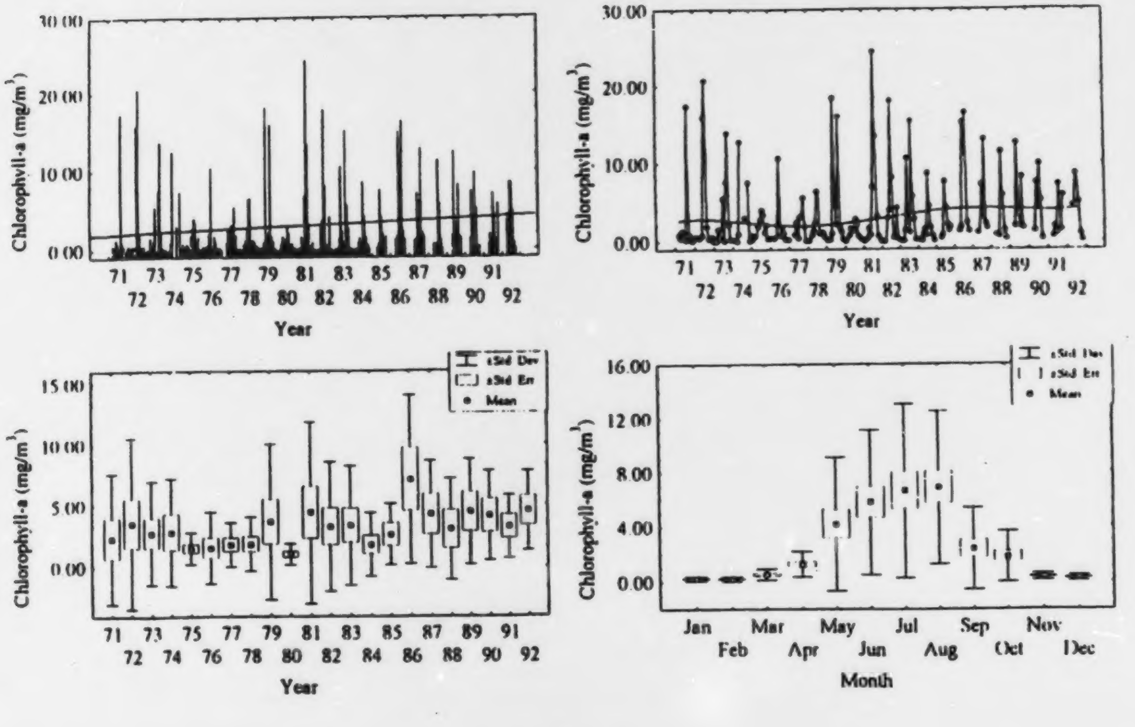


Figure 13. The concentration of chlorophyll a observed at station A from 1971 to 1992: a bar plot with linear fit (upper left), a line plot with polynomial fit (upper right), a box-whisker plot for annual means (lower left), and a box-whisker plot for seasonal means (lower right)

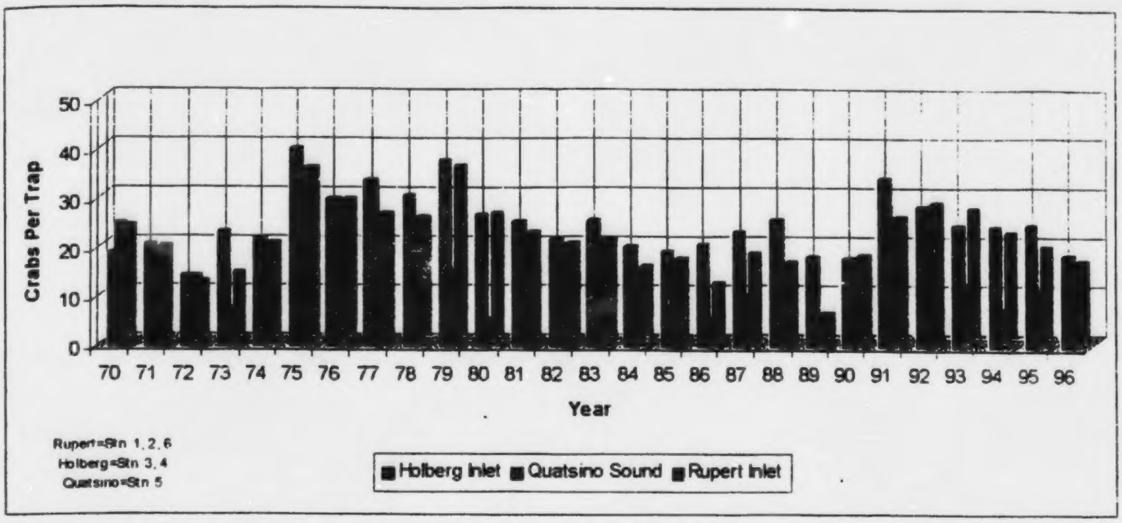
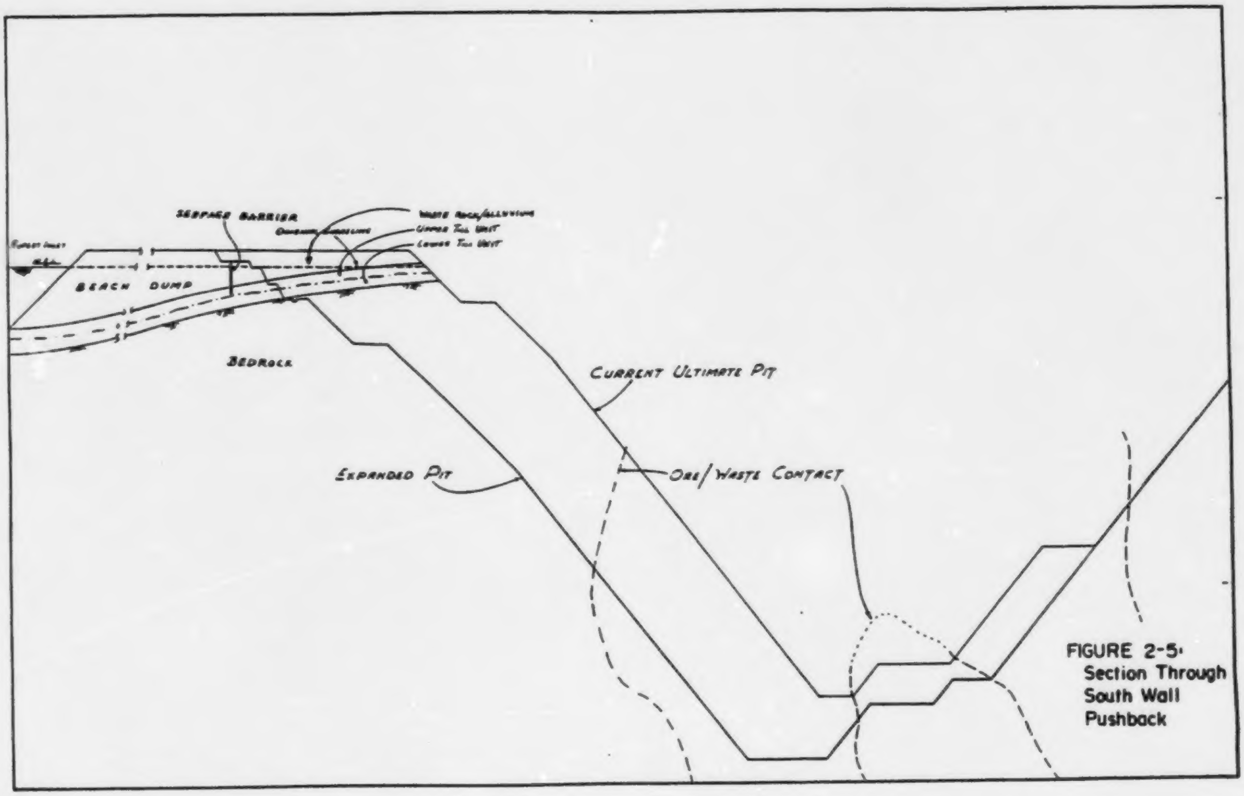


Figure 14. Dungeness Crabs - mean catch per trap.


Rupert Inlet
M.S.L.
Seepage Barrier
Original Shoreline
Waste Rock/Alluvium
Upper Till Unit
Lower Till Unit
Beach Dump
Bedrock
Current Ultimate Pit
Expanded Pit
Ore/Waste Contact
FIGURE 2-5
Section Through
South Wall
Pushback

15. Figure 15. Cross section through the Island Copper Mine open pit and marine waste

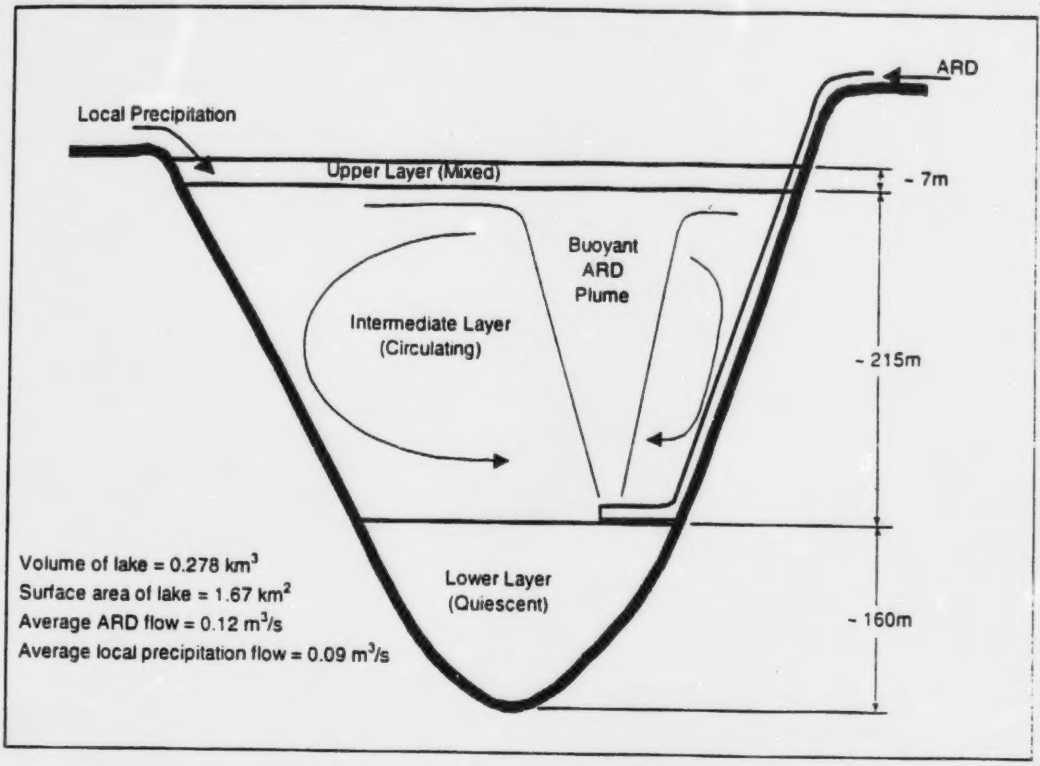

ARD
Local Precipitation
Upper Layer (Mixed)
~ 7m
Buoyant
ARD
Plume
Intermediate Layer
(Circulating)
~ 215m
Volume of lake = 0.278 km^3
Surface area of lake = 1.67 km^2
Average ARD flow = 0.12 m^3/s
Average local precipitation flow = 0.09 m^3/s
Lower Layer
(Quiescent)
~ 160m

Figure 16.Cross section of the Island Copper pit lake (Data from Dunbar, 1995)

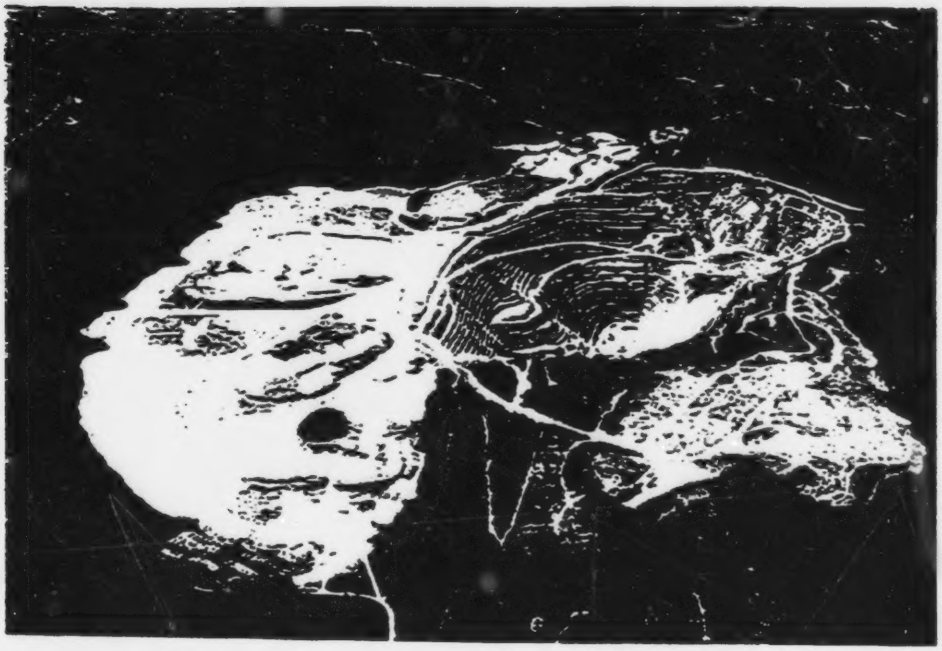


Figure 17. Looking east at the ultimate open pit with Rupert Inlet to the left.

Figure 18. Looking east at the flooded meromictic lake in the pit

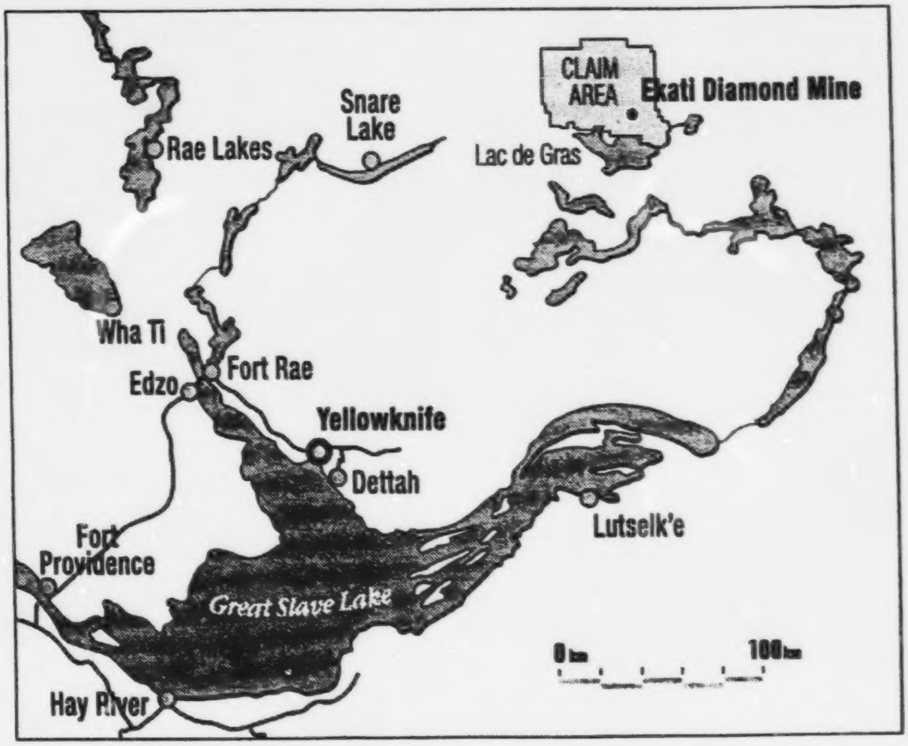

CLAIM AREA
Ekati Diamond Mine
Snare Lake
Rae Lakes
Lac de Gras
Wha Ti
Fort Rae
Edzo
Yellowknife
Dettah
Lutselk'e
Fort Providence
Great Slave Lake
0 km
100 km
Hay River

Figure 19. Location of the EKATI Diamond Mine

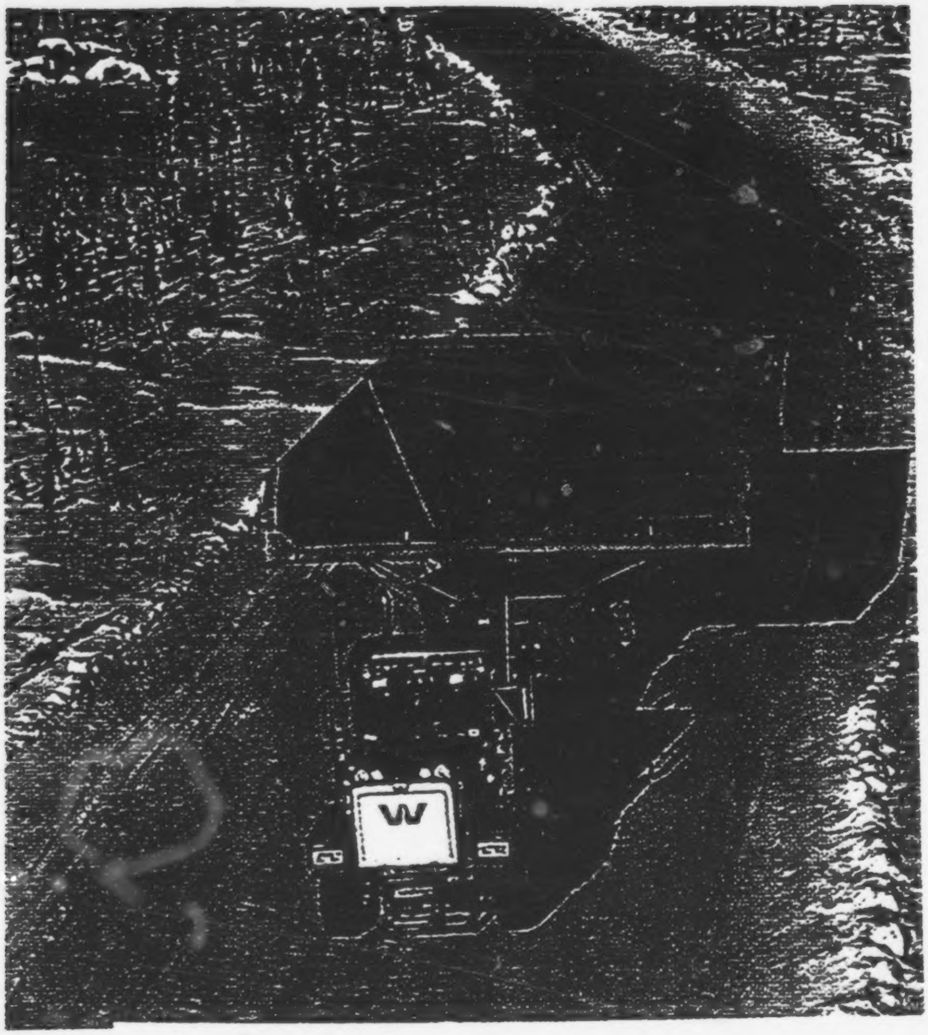


Figure 20. Truck transport over the winter ice road

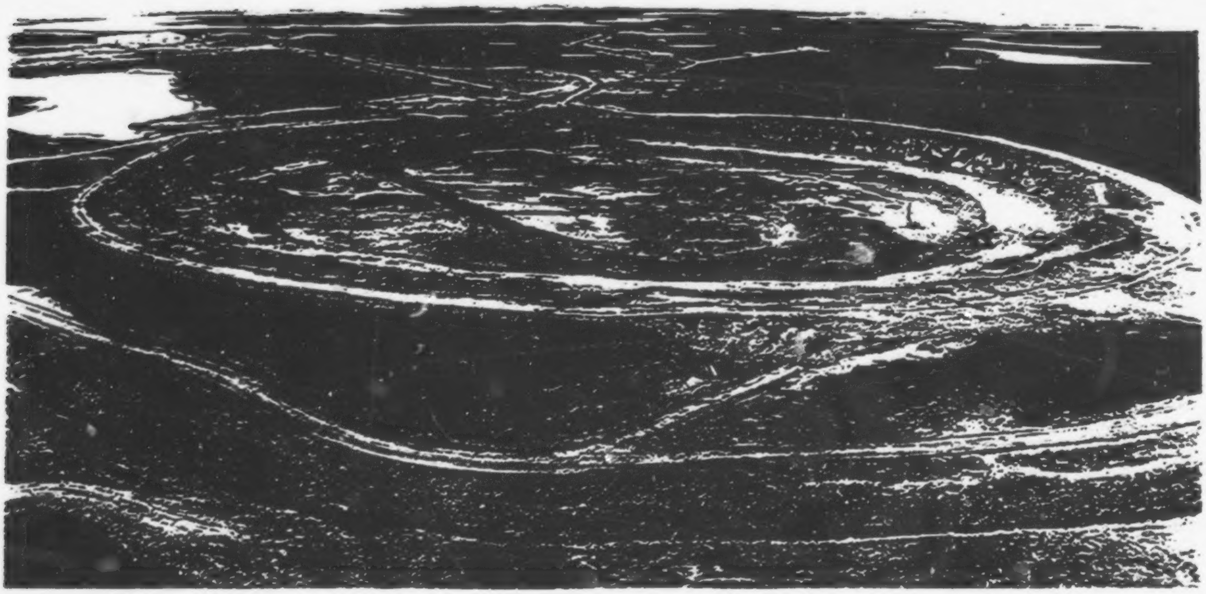


Figure 21. Panda open pit to extract the first diamonds at EKATI: process plant is seen in the top left.

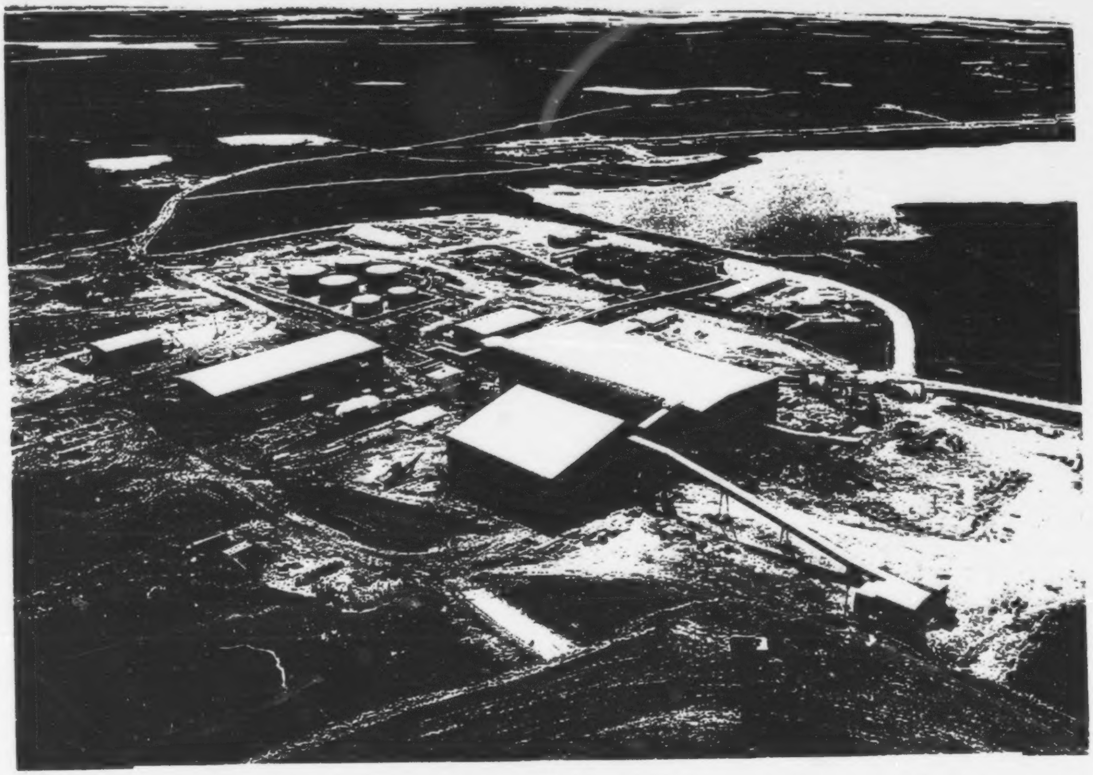


Figure 22. Ekati plant site: concentrator is the largest building in this view

Figure 23. A selection of both rough and cut and polished Ekati diamonds

Consulting, Engineering and Project Management

Dr. Kurt Strobele
Managing Director, North America
Hatch Associates Ltd.

CANADA: A WINDOW ON GLOBAL MINING
World-Class Technology and Investment Prospects
Canadian Embassy, Tokyo, Japan
February 17, 1999

Mr. Kurt Strobele,
Managing Director,
North America,
Hatch Associates Ltd.

Kurt Strobele was recently appointed Managing Director for Hatch North America.

He has more than 25 years experience in Metallurgical and Mineral Processing plant design, and Project and Construction Management. Dr. Strobele has been responsible for the development and direction of several major EPCM projects totalling more than $1 billion on behalf of Hatch clients.

Dr. Strobele received his Ph.D. Mechanical Engineering (1973) from McMaster University in Hamilton, Ontario, 75 kilometres west of Toronto. He also studied operations research and production at Munich University (1970).

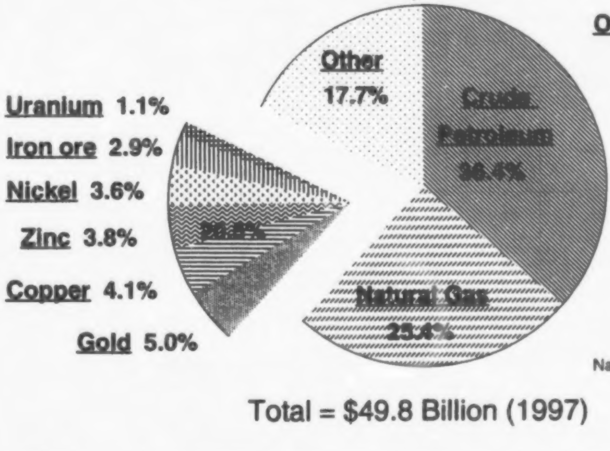
In 1994, Dr. Strobele was appointed Managing Director, Industrial Minerals. Prior to that he was Vice-President, Engineering for Hatch.

He is a member of the Professional Engineers of Ontario, the Engineering Institute of Canada, and the Institution of Mechanical Engineers (U.K.), and the author of several technical papers in his field.

Consulting, Engineering and Project Management in the Canadian Mining and Metals Industry

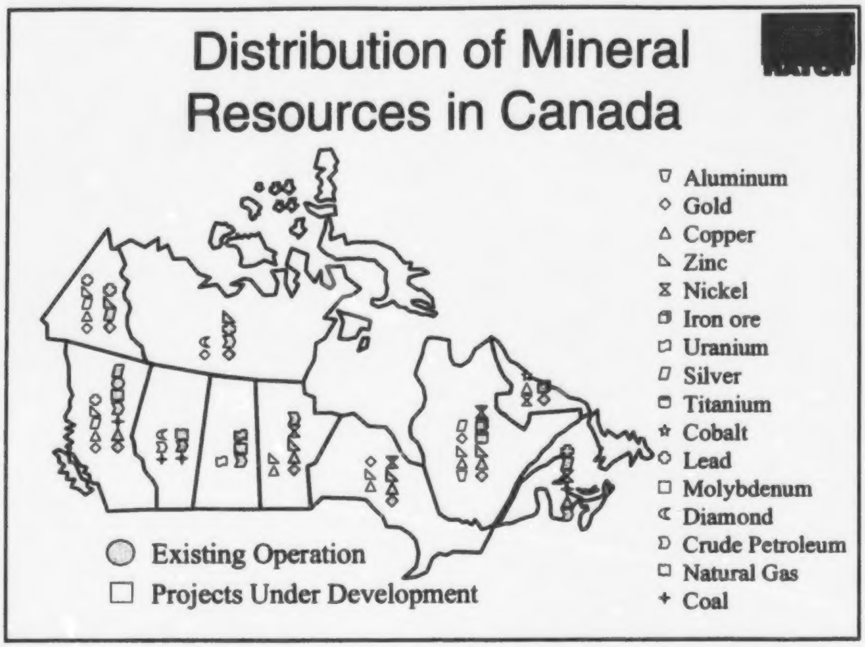
Dr. Kurt Strobele
Managing Director - North America

Value of Mineral Production by Commodity Type



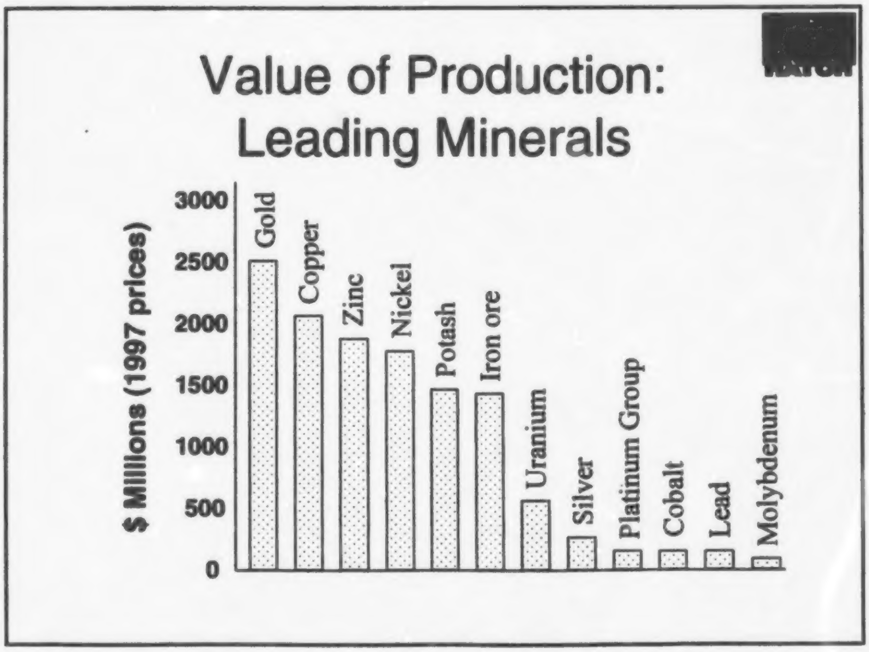
Other Includes:
Silver
Platinum Group
Cobalt
Lead
Molybdenum
Potash
Salt
Asbestos
Peat
Gypsum
Sulphur, elemental
Cement / Stone
Sand / Gravel
Lime
Clay
Coal
Natural gas by-products

Total = $49.8 Billion (1997)

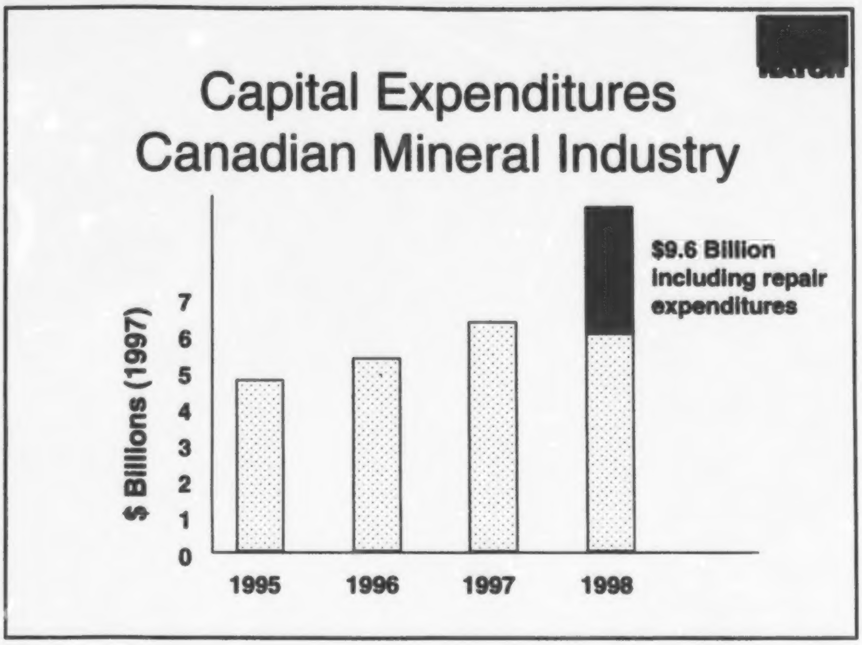


Distribution of Mineral Resources in Canada

▽ Aluminum
◇ Gold
△ Copper
◺ Zinc
⧗ Nickel
Iron ore
Uranium
Silver
Titanium
☆ Cobalt
○ Lead
☐ Molybdenum
Diamond
D Crude Petroleum
Natural Gas
+ Coal
● Existing Operation
☐ Projects Under Development

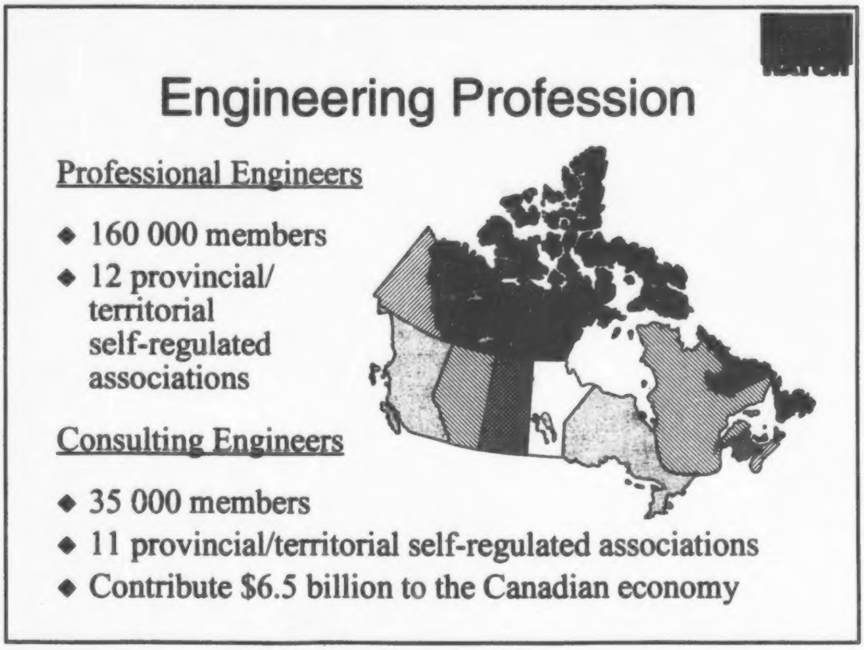


Value of Production: Leading Minerals



Capital Expenditures Canadian Mineral Industry

$9.6 Billion including repair expenditures



Engineering Profession

Professional Engineers

- 160 000 members
- 12 provincial/ territorial self-regulated associations

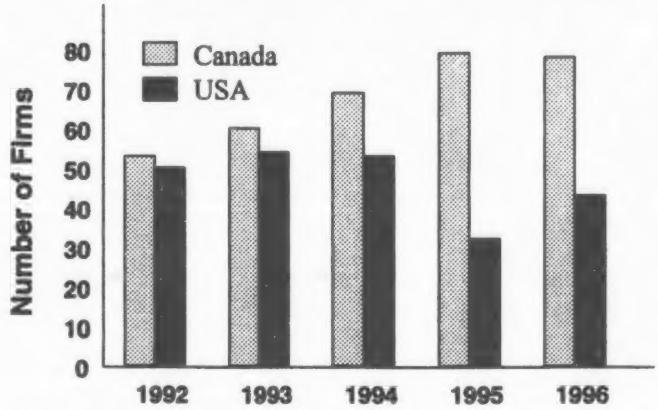
Consulting Engineers

- 35 000 members
- 11 provincial/territorial self-regulated associations
- Contribute $6.5 billion to the Canadian economy

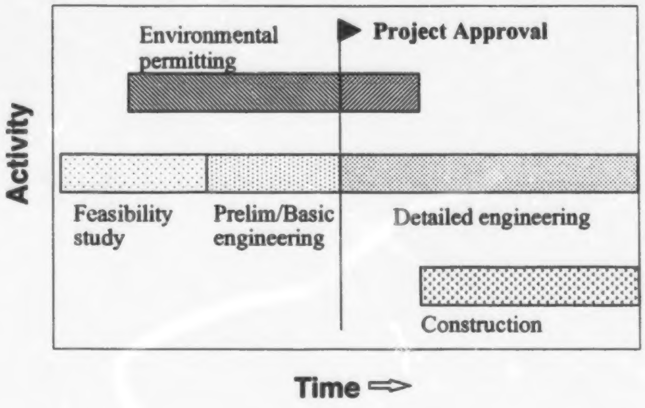
Consulting Engineering Companies in Canada

- ◆ Projects from less than $10 million to multi-billion$
- ◆ 700 companies nationwide, 11 large multinationals
- ◆ 63 with a strong focus on the mining industry

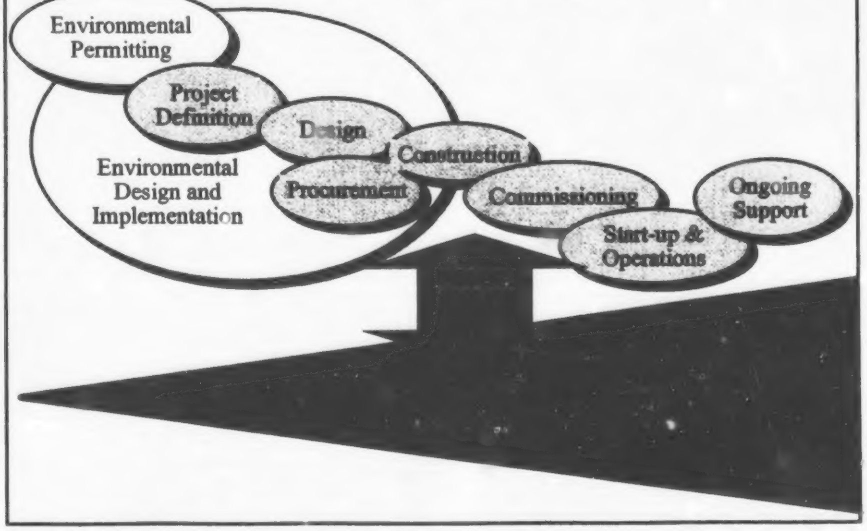
Involvement of Large International Design Firms

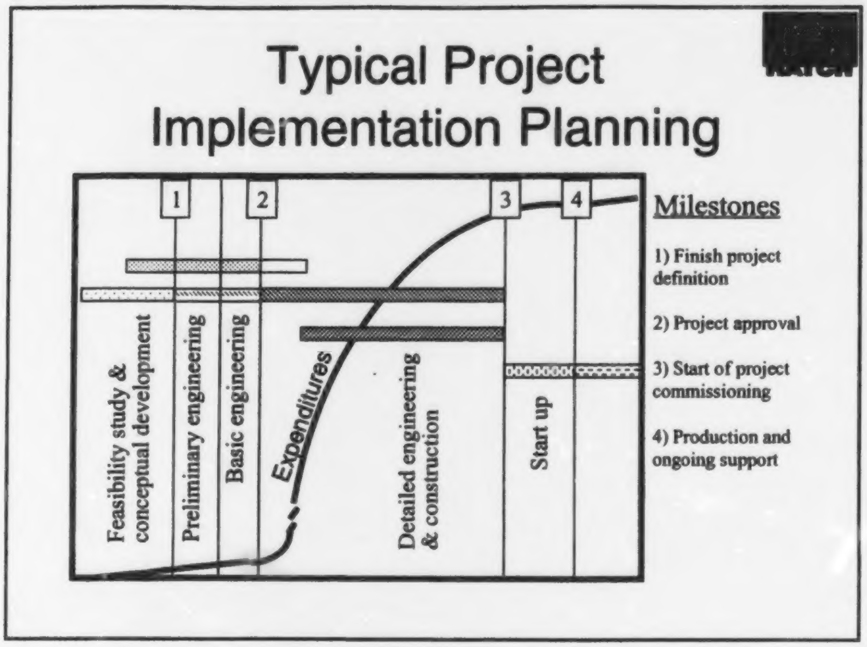


Role of Environmental Permitting in Project Scheduling



Project Implementation


Environmental Permitting
Project Definition
Design
Construction
Environmental Design and Implementation
Procurement
Commissioning
Ongoing Support
Start-up & Operations



Typical Project Implementation Planning

1
2
3
4
Feasibility study & conceptual development
Preliminary engineering
Basic engineering
Expenditures
Detailed engineering & construction
Start up

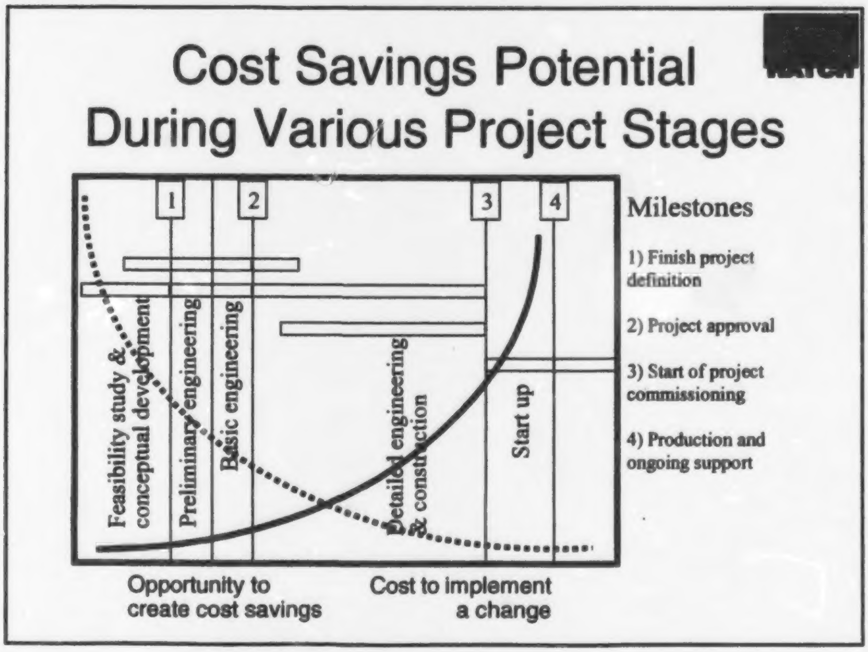
Milestones

1) Finish project definition

2) Project approval

3) Start of project commissioning

4) Production and ongoing support



Cost Savings Potential During Various Project Stages

1
2
3
4
Feasibility study & conceptual development
Preliminary engineering
Basic engineering
Detailed engineering & construction
Start up
Opportunity to create cost savings
Cost to implement a change

Milestones

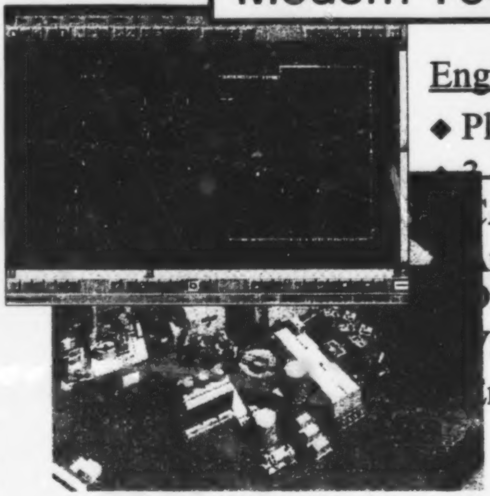
1) Finish project definition

2) Project approval

3) Start of project commissioning

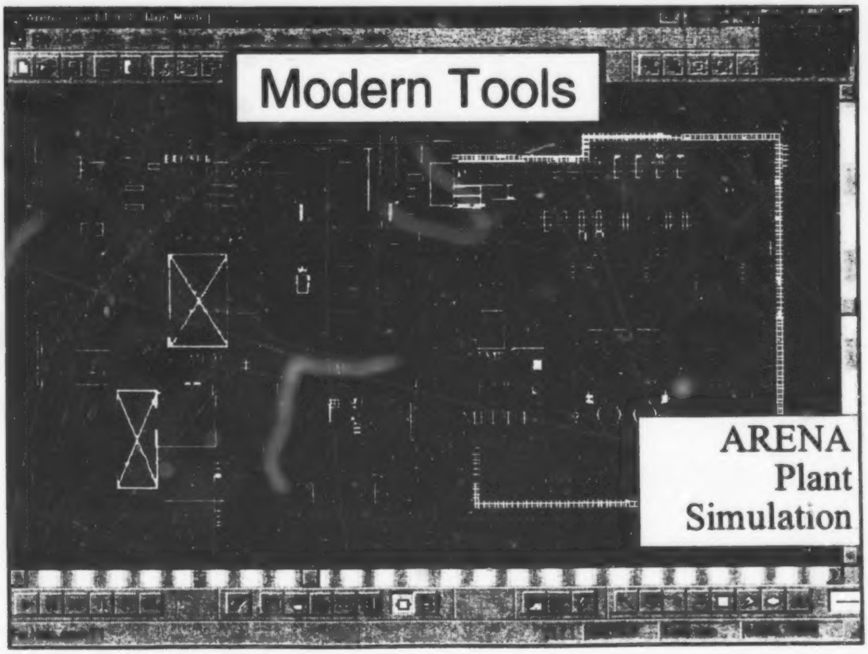
4) Production and ongoing support

Modern Tools



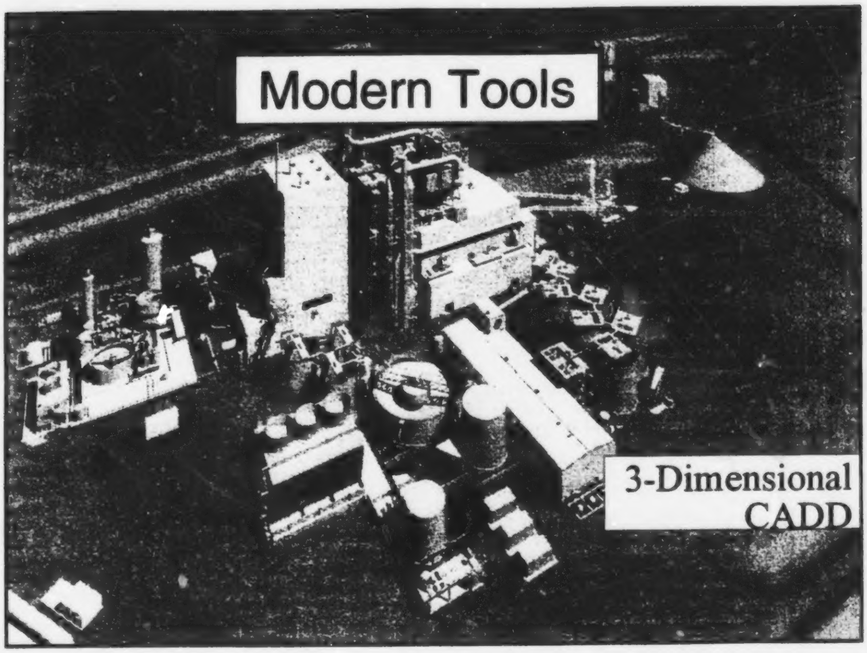
Engineering

- ◆ Plant Simulation
- -Dimensional
- ADD
- utomated Design
- rawing Production
- alue Engineering
- nergy Optimization



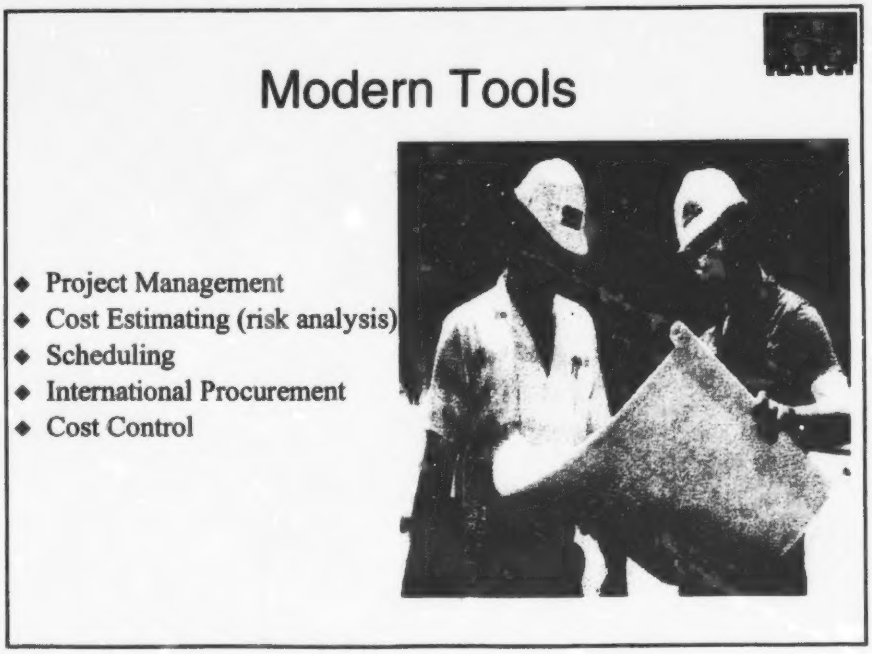
Modern Tools

ARENA
Plant
Simulation



Modern Tools

3-Dimensional CADD



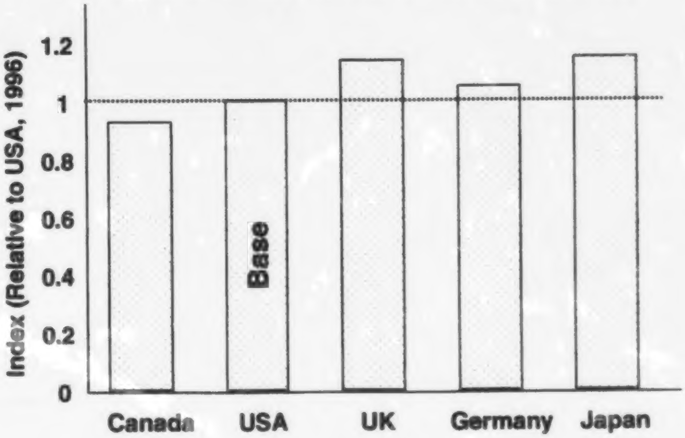
Modern Tools

- Project Management
- Cost Estimating (risk analysis)
- Scheduling
- International Procurement
- Cost Control

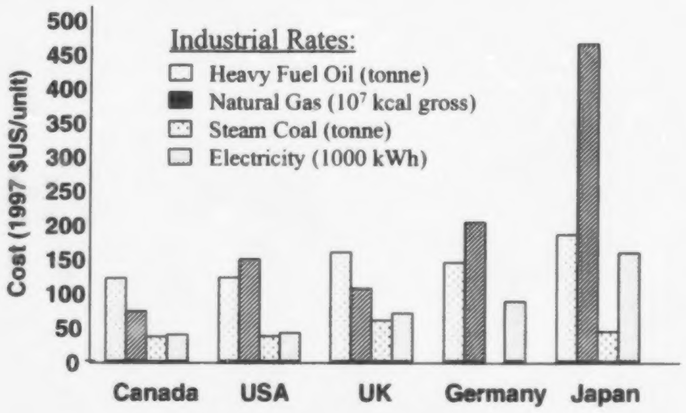
Modern Tools

- Project Management
- Cost Estimating (risk analysis)
- Scheduling
- International Procurement
- Cost Control
- Construction Management
- Safety Management

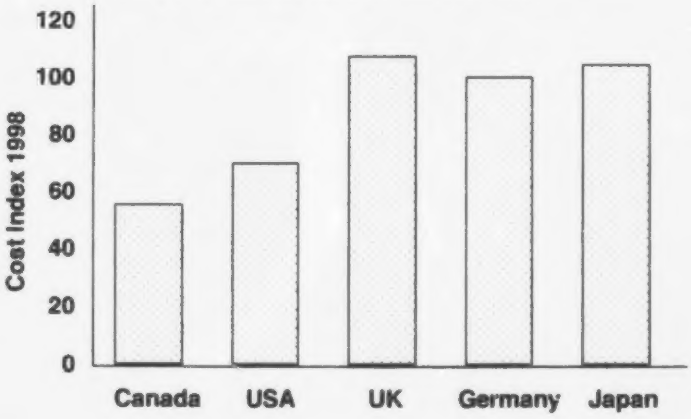
Capital Cost
Process Plant Construction



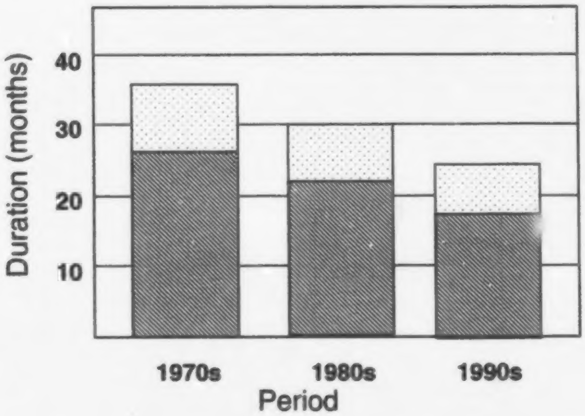
Operating Cost
Global Energy Prices



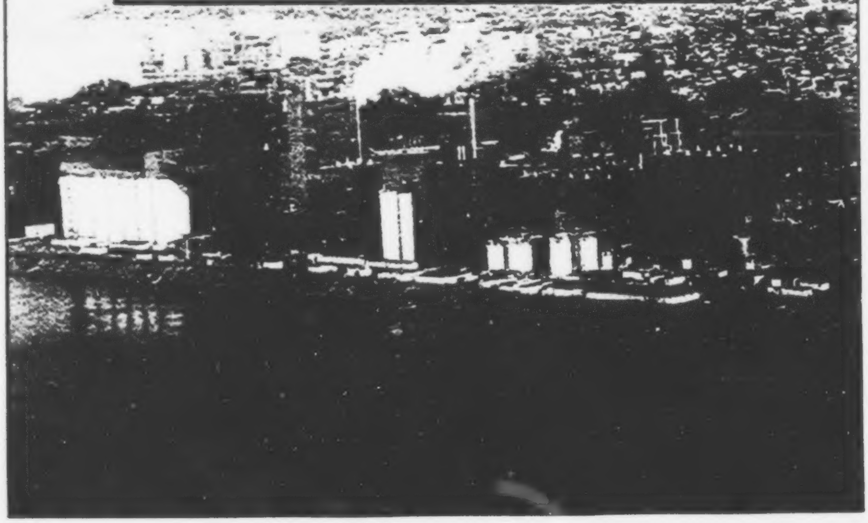
Operating Cost
Unit Labour Costs*

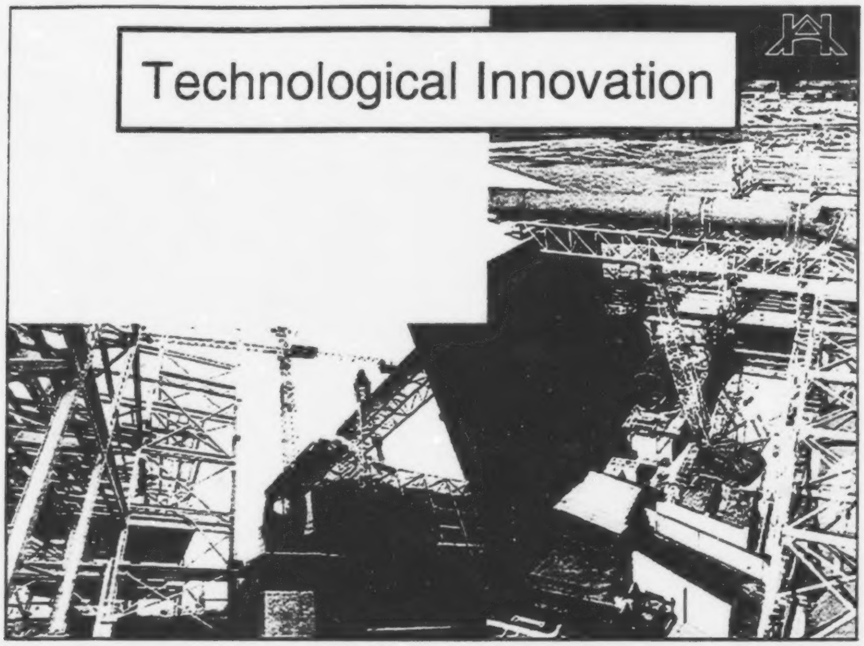


Trends in Detailed Design and Construction Duration



Technological Innovation





Technological Innovation

Technological Innovation

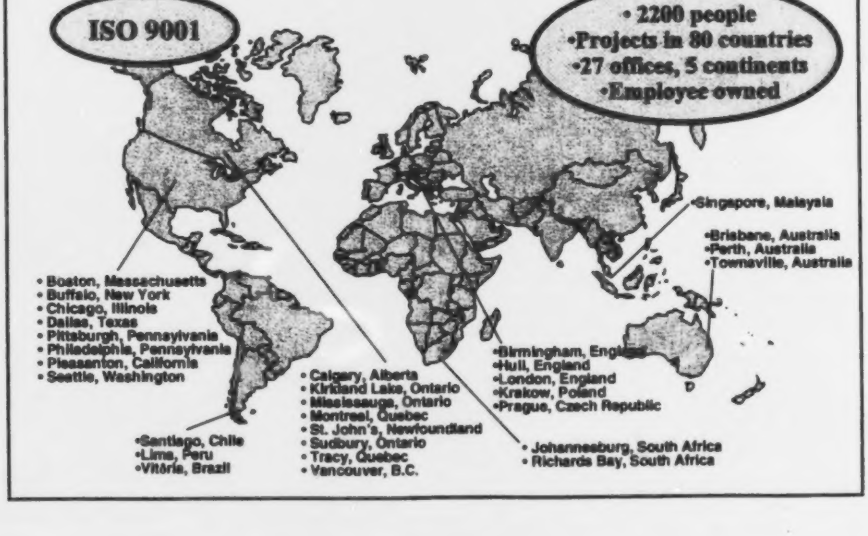
Profile of Hatch

- Consulting
- Engineering
- Construction

Principal Business Units
- Non-Ferrous
- Iron & Steel
- Industrial Minerals
- Light Metals
- Gold/Precious Metals
- Mining & Mineral Processing
- Infrastructure

Practice Areas
- Engineering
- Project Management & Constr.
- Advanced & Enterprise Systems
- Environmental Services
- Consulting to Management

Hatch Global Presence



ISO 9001

- 2200 people
- Projects in 80 countries
- 27 offices, 5 continents
- Employee owned

- Boston, Massachusetts
- Buffalo, New York
- Chicago, Illinois
- Dallas, Texas
- Pittsburgh, Pennsylvania
- Philadelphia, Pennsylvania
- Pleasanton, California
- Seattle, Washington

- Santiago, Chile
- Lima, Peru
- Vitória, Brazil

- Calgary, Alberta
- Kirkland Lake, Ontario
- Mississauga, Ontario
- Montreal, Quebec
- St. John's, Newfoundland
- Sudbury, Ontario
- Tracy, Quebec
- Vancouver, B.C.

- Birmingham, England
- Hull, England
- London, England
- Krakow, Poland
- Prague, Czech Republic

- Johannesburg, South Africa
- Richards Bay, South Africa

- Singapore, Malaysia

- Brisbane, Australia
- Perth, Australia
- Townsville, Australia

Hatch Vision

To be the world's pre-eminent supplier of technical and strategic services including Consulting, Information Technology, Engineering, Project Management and Construction to the Mining, Metallurgical, Manufacturing & Infrastructure industries

Addressing Industry Challenges Through Technology

CANADA: A WINDOW ON GLOBAL MINING
World-Class Technology and Investment Prospects
Canadian Embassy, Tokyo, Japan
February 16 and 17, 1999

Donald O. Downing
Vice President, Management Consulting
NorWest Mine Services Ltd.
Calgary, Alberta, Canada
www.norwestmines.com

NorWest
Mine Services Ltd.

Donald O. Downing

Vice President, Management Consulting
Norwest Mine Services Ltd.

Donald Downing is Vice President, Management Consulting with Norwest Mine Services Ltd.

Norwest is a specialized engineering and consulting company offering services to the coal and resource industries in Canada and internationally. The management consulting division of the firm's practice focuses on market analysis, operations efficiency and environmental projects with special emphasis on energy auditing and emission management strategies for mining companies.

Mr. Downing began his career as an exploration geologist in New Brunswick, Canada before becoming Director, Uranium Sales with Gulf Minerals Canada Ltd. He held various positions in Imperial Oil Ltd. between 1979 and 1991, and completed his career at Imperial Oil as President and CEO of Byron Creek Collieries.

He is the immediate past President of The Coal Association of Canada having served in that capacity for six years, 1993-1998.

Mr. Downing has held a variety of directorships in energy industry organizations and is currently a member of the:

- Marine Advisory Board to the Canadian Coast Guard;
- Industry Advisory Committee to the Vancouver Port Authority;
- Global Crossroads Transportation Task Force;
- Alberta & Canadian Geological Survey Advisory Committee.

He is married with three children and lives in Calgary, Alberta, Canada.

Education

B.Sc.(Geology) University of New Brunswick 1971
B.A. (Economics) University of New Brunswick 1974
M.Sc. (Mineral Economics) McGill University 1977
M.Sc. (Organization Development) Pepperdine U. 1991

Addressing Industry Challenges through Technology

Canadian companies are at the forefront of developing mining technology or adapting technologies for special circumstances. The competitive marketplaces in which Canadian mining firms operate combined with the often severe operating conditions dictate that Canadian mining companies continuously improve productivity and lower costs. Advanced technologies and technology practices have been essential to companies' progress in achieving their objectives in productivity and costs. Based on work in a variety of technology areas in Canada and internationally, Canadian engineering and consulting companies are well placed to facilitate both the export of Canadian expertise and support of international mining companies investing in Canada.

Using coal mining as a case in point, the presentation outlines some of the key areas of expertise in Canadian surface mining technology and related technologies.

Advanced mining technologies and technology practices are also key in managing the environmental impact of mining. Canadian expertise is already being applied in many countries in mitigating the effects of past mining and industrial development practices. Canadian firms are also well positioned to participate with firms from Japan or other countries to work jointly in third countries on coal-related projects (across the entire coal chain) or other mining-related projects that address international concerns about environmental impact, including greenhouse gas emissions.

It is a pleasure to be able to address this audience today on the subject of mining technology and technology practices. There are many developments in this field and changes are occurring at a rapid pace. Canadian companies have something to offer the world in this area, especially in the technology practices developed out of the special needs of Canadian mining conditions.

The presentation makes specific reference to Canada's surface coal mining industry and technological advances in that specific arena. There are good reasons to refer to the coal industry. Firstly, Canada is a major supplier to Japan and the Asia Pacific market, secondly, Japanese, Korean and other interests have invested in Canadian coal in the past, and finally, the industry is highly competitive and therefore has been successful in developing and implementing technical solutions and new technology practices.

Many of the specific cases to which I will refer are also representative of developments in large-scale surface mining generally in Canada (iron ore, base metals, oil sands). In fact some of the large surface mine operators work loosely together in addressing some of the cross-cutting technical issues affecting them.

Coal Mining

The evidence of technological advance in the industry lies in the trends in productivity and costs per tonne of coal produced. These indicators show how companies utilize new technology to drive costs down, compete, remain competitive and grow. Canada's coal mines are near the top in world productivity and western Canadian coal mines (95% of total production) taken as a group are the most productive of any major producing region.

Canadian developments in "geo-systems' which are computer-based geology and mine design and planning programs are amongst the best in the world. Canadian offerings in these areas compete against US, Australian and UK products and services. The Canadian programs are currently used by the University of Alberta for teaching in the engineering faculty.

Canadian companies are also leading in development of new applications satellite-based Global Positioning Systems (GPS) for use in mines. The GPS applications developed in Canada have included drill hole navigation and positioning, shovel positioning and truck dispatching in open pit coal mines in western Canada.

Heavy-duty equipment, like large trucks, now typically comes equipped with electronic monitoring devices of all kinds. The challenge for mines has been to capture the on-line monitor data, communicate it and analyze it. Canadian developments in data communication in mines are leading-edge. In fact the largest mines are developing Local Area Networks (LAN) for this data communication. Coal mines are involved although it is the oil sands mines that are leading in this area.

Several companies have the capability to write software which significantly improves the application of mine planning software, much of which has been originally developed outside Canada. This practice adds value to the CAD technology by, in effect, overlaying specific mine geological parameters.

The same value is being added to simulation software that allows the testing of many mine design alternatives at the feasibility stage.

Canadian companies are also involved in joint development contracts with equipment manufacturers. Although most of the heavy-duty mine trucks and shovels are manufactured outside Canada, prototyping and specialization is taking place in Canada. Equipment manufacturers like O&K, Caterpillar, P&H and HaulPac all have joint development contracts with large mines, which have lead to new equipment models especially suited for Canadian conditions. The focus is on balancing the variables of size and power to optimize efficiency, with increasing emphasis on vehicular emissions.

It is the current and prospective magnitude of the heavy equipment fleet in Canada that has led to these opportunities. The existing population and the prospects for growth in open pit mining mean that manufacturers are willing to let technology development occur in Canada.

Advances in mining equipment, networking, mine planning and geo-systems come together in the development of specialized data interfaces for equipment operators. Large shovel operators can be provided with monitors that display pit face geological and ore quality data that allows for improved quality control, and more efficient use of equipment.

Other mine-related research is taking place in wear materials and the development of abrasion-resistant materials for mine equipment. This research is aimed at improving the operating life and performance of key parts, such as truck bodies, shovel teeth and tires. Canadian companies are working with federal government bodies, National Research Council (NRC) and National Science and Engineering Research Council of Canada (NSERC) in this effort. Coal mining companies are also working in collaboration on areas of mutual interest. The Surface Mining and Research Technology (SMART) group is one such collaborative that includes major coal, base metal, oil sands and iron ore mining companies.

The coal companies are also working collaboratively with universities.

Coal Preparation*

Much of Canada's coal production and all the export coal requires some treatment prior to shipment. [* Coal preparation is also referred to as beneficiation and/or washing.]

Process control is the integral operating area for optimizing product recovery and achieving product specification as well as optimizing energy use leading to lower costs. The federal government organization, CANMET (Western Research Centre, supports technology development in this area and has developed comprehensive software (COPS - Coal Preparation Comprehensive Software; Plant Mass Yield Maximizer) to meet many of the coal preparation requirements in the Canadian coal industry. The software performs functions in the areas of data handling and manipulation, data analysis, performance evaluation and prediction, and graphics output. The technology has been applied in a wide ranging plant evaluation project that has involved 7 companies over a period of 5 years with CANMET as the primary contractor. The technology and practices developed in this project are highly transferable.

Developments in the coal preparation area are occurring in Programmable Logic Controller (PLC) and Direct Digital Control (DDC) systems. These applications are leading the progress toward fully automated plants and are used for sequential start-up, shutdown and re-start schemes and for monitoring and control of processes. Process control in the coal flotation circuits is using nuclear ash** monitoring systems. At least one mine has acted in collaboration with provincial government, CANMET and equipment designers to implement process control systems that integrate on-line ash monitoring using a nuclear ash monitoring system with the overall plant operating systems. Canadian designs are emerging from this work. [** Ash is the term used to refer to impurities in coal.]

Progress in each of the areas discussed above is preparing the way for complete integration of systems in the future. One can foresee the future implementation of data, analysis and control systems integrated from planning through to mine operations and the plant process leading to improved resource management, quality control and ultimately, to improved efficiency in coal utilization.

Transportation

The bulk commodities and the railways have a strong reciprocal dependence; each relies on the other for survival and success. On the one hand coal can only be transported long distances in Canada by rail while on the other hand it is the largest commodity by volume moved by rail in Canada and is therefore essential to the railways' revenue.

Modern rail transportation of bulk commodities such as coal requires highly efficient, cost-effective carriage of the product and efficient management of the railway's overall traffic system.

New large locomotives are more powerful and more energy efficient and utilize Canadian expertise. General Electric, located in London, Ontario, is a major supplier of new large locomotives to the major rail companies carrying coal.

In addition the latest traffic management and dispatching systems utilize Canadian expertise. CP Rail recently opened a world leading facility in Calgary which illustrates the state of the art in this area.

Training

Simulation technology which has application in aeronautics and flight training has been extended to heavy equipment training by Canadian firms. These applications will lead to safer operations and lower operating costs.

Transfer of Technology - Cases in International Environmental Improvement

Norwest Mine Services is representative of Canadian engineering and consulting companies that deliver mining technical expertise to other countries in projects that improve local environmental conditions by rehabilitating previously mined areas (air, water and land), and/or by providing designs for new operations that incorporate modern Canadian technical and engineering standards.

Norwest is active in several countries including India, Mongolia, China, Colombia and Venezuela. These countries are all members of the group which to date have not undertaken any commitments regarding greenhouse gas emissions, but which are prospective bases for joint projects with developed countries which have made commitments, such as Canada and Japan.

In India, for example Norwest has been involved for years in large-scale mined area rehabilitation that has led to significant improvements in air quality generally with specific reductions in CO2 and methane. Additionally, technical and engineering expertise in mine planning, operations and maintenance management, coal beneficiation (washing) and reclamation has been delivered. This type of work has a direct impact on the efficiency of coal mining, transportation and utilization and significantly reduces emissions of all kinds. The expertise has been developed in Canada with other Canadian companies and can be transferred.

Addressing Industry Challenges Through Technology

The Mining Investment Conference 1999
Tokyo, Japan

NorWest
Mine Services Ltd.

Canadian Mining Technological Possibilities

- *Apply technology & practices*
- *Jointly develop new applications*
- *Extend collaborative efforts to third countries*

NorWest
Mine Services Ltd.

Technology Areas

- *Mining*
- *Processing*
- *Transportation*
- *Environmental*

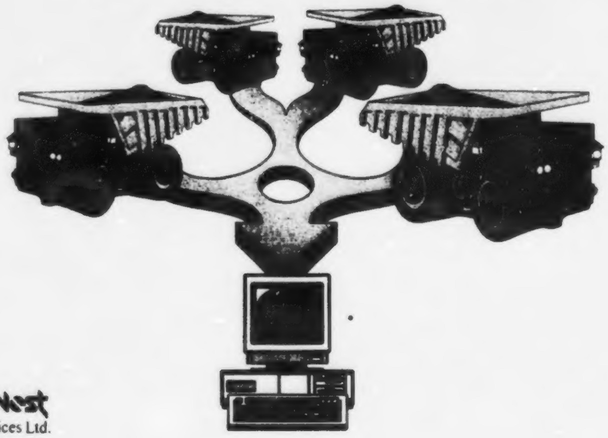
NorWest
Mine Services Ltd.

Trends in Coal Mining Technology

- *CAD mine planning - specialized software*
- *CAD maintenance planning*
- *Heavy duty equipment*
- *Networks & analysis*
- *Plant process control*

NorWest
Mine Services Ltd.

Truck Data Monitoring



NorWest
Mine Services Ltd.

Trends in Transportation Technology

- *Fuel-efficient power*
- *More power*
- *Lighter railcars*
- *New fuels*
- *Dispatch systems*

NorWest
Mine Services Ltd.

The Fifth APEC Coal Flow Seminar

The Canadian Coal Industry Current Status & Outlook

NorWest
Mine Services Ltd.

Gartner
Lee
Limited

CANADA: A WINDOW ON GLOBAL MINING

Approval of Mining Projects in Canada: Examples from the Yukon and British Columbia

by

Stephen Morison
Manager/Senior Geoscientist
Gartner Lee Limited

Stephen R. Morison
Principle and Senior Geoscientist
Gartner Lee Limited

Mr. Morison has been involved in Canada's mining industry for 20 years as a geoscientist with the Geological Survey of Canada, as an Exploration Geologist in northern Saskatchewan, as the Chief Geologist and Director of Mineral Resources for Yukon Territory and as an environmental consultant. As the Director of Mineral Resources , Department of Indian Affairs and Northern Development for Yukon Territory, Mr. Morison has been responsible for negotiating and introducing changes to federal statutes such as the Yukon Quartz Mining Act and Yukon Placer Mining Act. He has also been responsible for negotiating new federal statutes in support of land claims in Yukon Territory. Since leaving the federal government., Mr. Morison has established an active consulting practice with the mining industry in British Columbia, Yukon Territory and Northwest Territories.

Government

- Jurisdiction of provincial governments.
- The federal government continues to be responsible for managing natural resources in Yukon Territory and Northwest Territories.
- Although each province and territory have their own enabling legislation to regulate the mining industry there are common factors and approaches which are applied across the country.

Gartner
Lee
Limited

Summary Table of Provincial Legislation / Regulations

Provincial Jurisdiction	Statute and Regulations
Alberta	• Mines and Minerals Act • Crown Land Registration Regulation • Exploration Regulation • Forms Regulation • Metallic Minerals Regulation • Mineral Rights Compensation Regulation • Public Lands Act • Mineral Surface Lease Act
British Columbia	• B.C. Mining Act • Waste Management Act • B.C. Environmental Assessment Act • Waters Act
Manitoba	• Mines Act • Mineral Disposition Regulation, 1981
Newfoundland	• Mineral Act, 1976 • Mineral Regulations, 1983
Nova Scotia	• Mineral Resources Act • Boundaries of Mineral Lands Regulations • Work on Mineral Rights Regulations
Ontario	• Mining Act • Environmental Protection Act • Ontario Water Resources Act • Waste Management Regulation • Intervenor Funding Act
Prince Edward Island	• Mineral Resources Act • Work Requirement Regulations
Quebec	• Mining Act
Saskatchewan	• Crown Minerals Act • Mineral Disposition Regulations, 1986 • Provincial Lands Act • Resources Lands Regulations

Gartner
Lee
Limited

Summary of Federal Legislation / Regulations

Federal Jurisdiction	Statute/Regulations/Boards/Policies
Northwest Territories	• Territorial Lands Act and Regulations • Canada Mining Regulations • Northwest Territories Water Act and Regulations-NWT Water Board • Canadian Environmental Assessment Act (CEAA) • MacKenszie Valley Resource Management Act
Nunavut	• Nunavut Water Act and Regulations-Nunavut Water Board • Nunavut Impact Review Board (NIRB) • Nunavut Land Use Planning Board • Nunavut Tunngavik Incorporated (NTI)- Exploration Agreements/Production Leases • NTI Mining Policy • Territorial Lands Act and Regulations • Canada Mining Regulations
Yukon Territory	• Territorial Lands Act and Regulations • Yukon Waters Act and Regulations • Yukon Quartz Mining Act ⇒ Mining Land Use Regulations (MLUR) ⇒ Mine Site Reclamation Regulations (MSRR) • Yukon Placer Mining Act ⇒ Mining Land Use Regulations (MLUR) • Development Assessment Process (DAP) • Canadian Environmental Assessment Act (CEAA)
Federal Statutes-General	• Fisheries Act • Canadian Environmental Protection Act (CEPA) • Canadian Environmental Assessment Act (CEAA)

- Northern Canada is evolving to a system where environmental assessment and regulatory decisions are made through public boards which are community driven.
- Northern Canada is in a period of transition where land claims and self government initiatives are being negotiated and in some areas finalized. For example, Yukon Territory has an Land Claims Umbrella Final Agreement in place. This provides for legal certainty for the mining industry.

Gartner
Lee
Limited

Mineral Tenure

- Each province and territory has legislation which provides the mining industry with subsurface rights.

- Secure mineral rights forms a fundamental aspect for the exploration and mining industry in Canada which is crucial for access to lands and legal certainty.

- Canada has a good track record in maintaining a secure system of mineral rights for the mining industry.

- Some jurisdictions such as Yukon Territory include the "right to mine" with mineral tenure. The environmental and regulatory statutes which govern mining do not take way this right, but rather "fetter" this right by allowing projects to proceed after obtaining the appropriate certificates, authorities, permits and licenses.

Gartner
Lee
Limited

Environmental Assessment in Canada

- Purpose:
  - ⇒ Consideration of environmental effects
  - ⇒ To encourage sustainable development
  - ⇒ Ensure there are no significant adverse environmental effects
  - ⇒ To ensure public participation
- Typically, a mining proponent would do the following:
  - ⇒ Prepare a project description/application for review
  - ⇒ Design and implement an environmental baseline program.
  - ⇒ Prepare an initial environmental assessment with mitigative measures
  - ⇒ Review by government agencies
  - ⇒ Initiation of a public review process
  - ⇒ Analysis of public concerns by government
  - ⇒ Approval

Gartner
Lee
Limited

Environmental Assessment- Issues

- The practice of environmental assessment continues to evolve in Canada
- Challenges include:

⇒Harmonization

⇒Narrowing the baseline scope as much as possible

⇒Achieving "buy-in" with government agencies, aboriginal communities and key stakeholders as the environmental assessment process evolves

⇒Integration of environmental management systems with conceptual engineering design

⇒Linkage and integration of environmental baseline information and monitoring with Traditional Ecological Knowledge (TEK)

⇒Dealing with public perception.

Gartner
Lee
Limited

Environmental Assessment- Tools

- A colleague of mine once told me that man-kind has become a "geological agent".
- Management of natural resources armed with knowledge and understanding. This includes First Nations traditional knowledge.
- Both the proponent and government agencies generally do not assess the "function" of the environment which is being impacted and do not strategically target mitigation measures to deal with the critical issues.
- Functional assessment includes traditional land use and cultural issues:
  - ⇒ Function- Understanding Environmental Processes
  - ⇒ Attributes- Unique or special characteristics
  - ⇒ Linkages- Interaction or connection of components in the ecosystem
- Important tool for putting environmental issues and cultural issues in context.
- Strategic Planning and Environmental Management

Gartner
Lee
Limited

Strategic Planning and Environmental Management

- Critical Path
- Risk Assessment
- Consultation Strategy for Aboriginal Communities, Government Agencies, Stakeholders and the General Public
- Issues Tracking and Contact Database
- Desk Top Environmental Assessment (scoping) for review by regulatory agencies, aboriginal communities and stakeholders
- Linkage with Compliance Monitoring
- Assessment of Cumulative Effects
- Traditional Ecological Knowledge and linkage with environmental baseline programs
- Introduction of accepted environmental standards
- Environmental integration and linkages with engineering concepts
- Internal workshops, public workshops, open houses, newsletters

Gartner
Lee
Limited

Regulatory Approvals

- Upon completion of the environmental assessment hurdle, a mining proponent then moves into the regulatory stage which gives the proponent the authority to proceed to the licensing and permitting phase.
- The following is a list of some of the issues which are associated with the regulatory stage:
  - ⇒ waste discharge
  - ⇒ water quality
  - ⇒ land use impacts
  - ⇒ security/bonding
  - ⇒ reclamation and closure
  - ⇒ detailed engineering design
  - ⇒ mine safety and occupational standards
  - ⇒ detailed monitoring plans

Gartner
Lee
Limited

Environmental Monitoring:

- 2 types:
  - ⇒Compliance Monitoring (regulatory)
  - ⇒Collection of baseline information for environmental assessment
- Examples Include: Surface water (quantity/quality); subsurface water (quantity/quality); fish and fish habitat (benthic invertebrates); terrain/soil conditions (baseline map); site assessment (previous mining activities).
- Environmental Effects Monitoring (EEM)- To document existing conditions and to assess long term impacts

Government Agencies

- Obtaining an authority, permit or license from a government agency can be facilitated by achieving "buy-in" on strategies/critical paths, the provision and integration of high quality technical information and environmental planning.
- The mining proponent should help government solve their problems but also hold officials accountable to agreements, time frames etc.
- Simply relying on the "process" does not work due to factors such as:
    - ⇒ competition with other proponents who are also seeking approvals;
    - ⇒ lack of qualified government personnel and fiscal resources to react to mining proposals in a timely fashion given the drastic cutbacks and reductions of the provincial and federal public service; and
    - ⇒ the high degree of bureaucratic flexibility and thus lack of accountability (e.g., time frames) in approving mining project proposals.

Gartner
Lee
Limited

Consultation

- A crucial component for a mining proponent in securing approval for a project is to put in place a consultation strategy over and above the opportunities offered by government agencies.
- A mining company which involves key stakeholders at virtually every stage of a project can reduce risk and receive approval from government agencies on a more timely basis.

Gartner
Lee
Limited

Aboriginal Issues

- Aboriginal communities are regarded by provincial and federal governments as key stakeholders who will ultimately have significant input into the approval of a development project.

- It is crucial that the mining industry treat aboriginal groups as another level of government to achieve support for a project.

- A mining company which involves aboriginal communities early in the project (e.g., at the exploration stage) and develops a rapport based on trust and respect will find the government environmental assessment and regulatory processes less onerous.

Special Interest Groups

- There are special interest groups who will oppose development projects regardless of the efforts made by the mining proponent.
- There are other special interest groups who have a conservation focus yet also believe and support the concept of "sustainable development".
- The challenge for the mining proponent is to prepare a strategy which identifies which groups can assess a proposed mining project from at technical perspective and deal with issues on this basis.
- Public perception and media coverage especially at the public hearing stage is an crucial time for a proposed mining project in terms of obtaining an authority to proceed in a timely fashion.
- It is for this reason that a mining proponent must have a clear strategy to deal with the general public and special interest groups plus an effective and targeted baseline and monitoring program to deal with environmental issues from the technical perspective.

Gartner
Lee
Limited

Yukon Territory

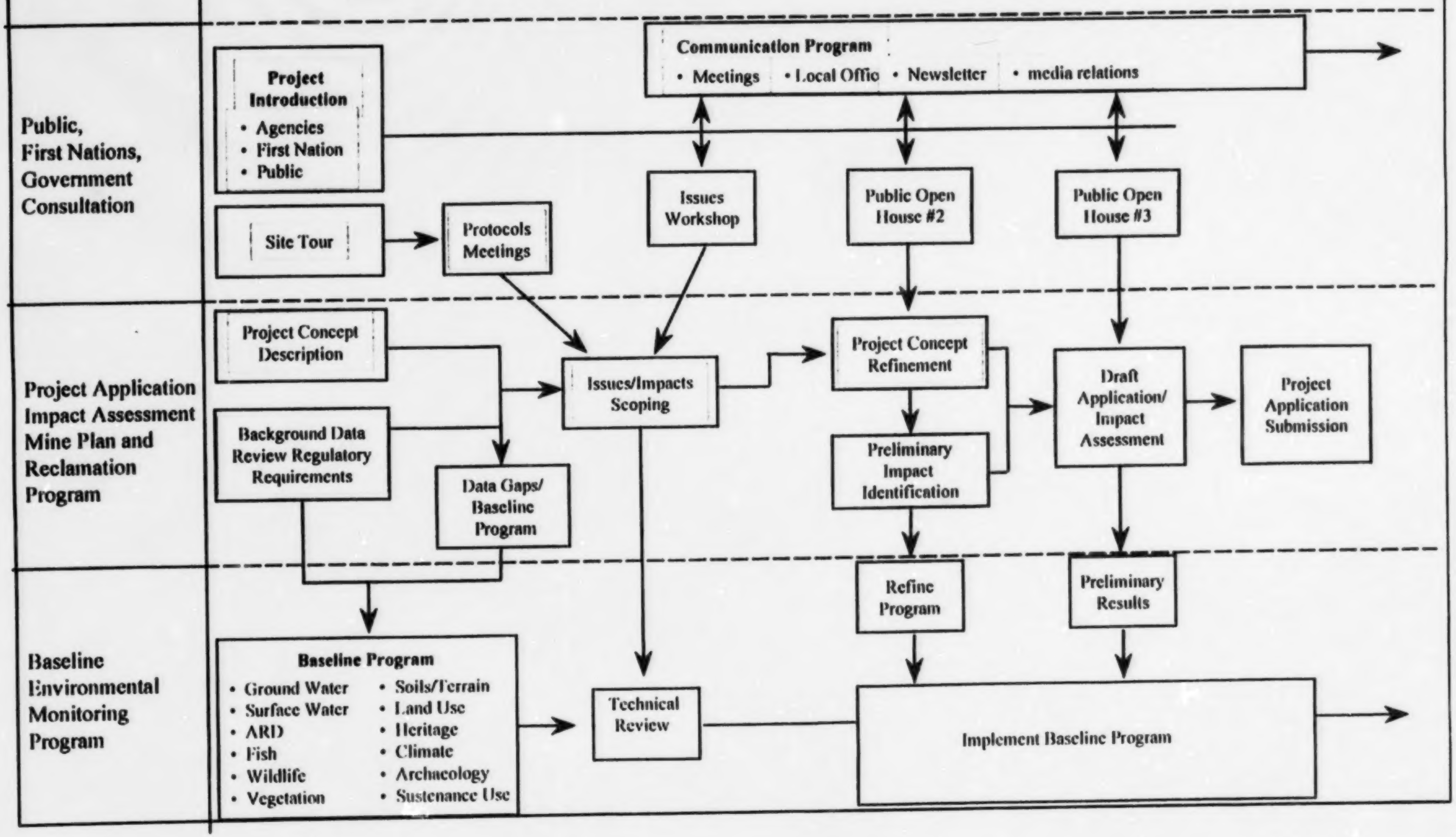
- Advantages:
  - ⇒ Significant mineral potential
  - ⇒ Stable regulatory regime with supportive territorial government
  - ⇒ No duplication (CEAA applies)
  - ⇒ Devolution of natural resources management from the federal government is a priority
  - ⇒ "Right to Mine"
  - ⇒ Legal certainty- Water License and Production License
  - ⇒ Settled land claims
  - ⇒ Local mining culture
  - ⇒ Strong services sector to support exploration and mining
- Examples:
  - ⇒ 200 active placer gold mines
  - ⇒ 2 producing hard rock gold mines
  - ⇒ Mining Projects at License Stage:
    - Kudz Ze Kayah- IBA in place
    - Minto- IBA in place

Gartner
Lee
Limited

Case History: Canarc Resources Corp. (New Polaris Project)

- Highly sensitive area in the Tulsequah River Valley across from Tulsequah Chief
- Environmental scoping prior to regulatory permits (e.g. Water Discharge Permit)
- Environmental strategy used for applications (e.g. Water Discharge-mass balance for regulatory level of metals)
- High degree of training for on-site personnel to reduce overall consulting costs
- High level of communication early in the project with the aboriginal community (TRTFN) with a commitment on both sides to maintain dialogue
- Joint work with the TRTFN early in the exploration program such as the delivery of an environmental assessment workshop.
- Joint government/Canarc funding to hire a TRTFN "Technical Liaison Officer" responsible for:
  ⇒ assessment of all permit applications
  ⇒ on-site environmental training
  ⇒ community outreach
- Exploration IBA and communication protocols

Example of Environmental Approvals Strategy for a Mining Project in Canada


Public, First Nations, Government Consultation
Project Application Impact Assessment Mine Plan and Reclamation Program
Baseline Environmental Monitoring Program
Project Introduction
• Agencies
• First Nation
• Public
Site Tour
Protocols Meetings
Communication Program
• Meetings
• Local Offic
• Newsletter
• media relations
Issues Workshop
Public Open House #2
Public Open House #3
Project Concept Description
Background Data Review Regulatory Requirements
Data Gaps/ Baseline Program
Issues/Impacts Scoping
Project Concept Refinement
Preliminary Impact Identification
Draft Application/ Impact Assessment
Project Application Submission
Baseline Program
• Ground Water
• Surface Water
• ARD
• Fish
• Wildlife
• Vegetation
• Soils/Terrain
• Land Use
• Heritage
• Climate
• Archaeology
• Sustenance Use
Technical Review
Refine Program
Preliminary Results
Implement Baseline Program

Gartner
Lee
Limited

Summary

- Environmental Assessment:

  ⇒ "People Problems"

  ⇒ Current technology can deal with environmental issues

  ⇒ Projects must be scoped (e.g. Desk Top EA) and strategically assessed to manage the process, reduce overall costs and reduce risk

  ⇒ First Nations People-

    Respect

    Another level of government

    Trust building is crucial as early as possible

    Supportive role when dealing with government agencies

    Training, job shadowing, capacity building

- Mining approvals generally require 2 to 5 years

- Permitting mining projects can be done in a cost effective and timely manner if the mining proponent conducts business in a professional manner from a ***"people perspective"***.

- Canada has a stable government system which is not corrupt and many appeal mechanisms which benefit the mining proponent.

Additional Biographies

Moderator and Exhibitors

CANADA: A WINDOW ON GLOBAL MINING
World-Class Technology and Investment Prospects
Canadian Embassy, Tokyo, Japan
February 16 - 17, 1999

Robert B. Parsons

Partner

PricewaterhouseCoopers

Bob is a partner in PricewaterhouseCoopers' Jakarta office, where he heads up the firm's Indonesian mining practice. Prior to transferring to Jakarta in 1997, Bob was based in Toronto, Canada where he served as Chairman of the firm's global mining practice. Bob has specialized in the mining industry since 1974. He is a member of the Board of Directors of both the Prospectors and Developers Association of Canada, and the Indonesian Mining Association. In the past, Bob served on the Executive Council of the Canadian Mineral Industry Federation, and the Advisory Council of the Centre for Resource Studies at Queens University.

John Broome

Head, Geoscience Integration Section
Regional Geology Subdivision, Continental Geoscience Division
Geological Survey of Canada

Graduated from Queen's University in 1975 with a B.Sc. (Engineering) Geology and worked work in the geophysical consulting industry from 1979-1983 collecting and interpreting airborne geophysical data. Joined the Geological Survey of Canada in 1983 and conducted research on computerized visualization, modeling, and interpretation of potential field and other geophysical data. In 1989 obtained an M.Sc. Geology from Carleton University in Ottawa. Since 1994, Mr. Broome has been Head of the Geoscience Integration Section at the Geological Survey of Canada and involved in development and application of digital data management and analysis techniques for NATMAP, Lithoprobe, and other geoscience projects. In 1998, Mr. Broome became the leader of the GSC team developing the Geoscience Knowledge Network and a participant in the federal-provincial team developing the broader Canadian Geoscience Knowledge Network.

Gilles Dupuis

President and General Director (CEO)
Lithos and Limtech

Profession: Engineer
Nationality: Canadian
Languages: French and English
Born: September 19, 1949

Education

1970 Bachelor's Degree in Applied Sciences, Mechanical Engineering
École Polytechnique, Montréal, Province of Québec

Professional Associations

- Member of the *Ordre des Ingénieurs du Québec* (Quebec Order of Engineers)
- Member of the *American Society of Heating, Refrigeration and Air Conditioning Engineers Inc.*
- Member of the *Ligue de l'Électricité du Québec*

Employment History

1998	**Lithos & Limtech**, President and General Director (CEO) of the two companies (Lithos is listed on the Montreal stock exchange market LTS)
1997	**Limtech**, President and General Director (CEO) (Company owns by Lithos)
1996	**Soprin-ADS**, Vice-President International Construction Engineering
1995	**ADS Groupe Conseil Inc**, President of the Engineering group, member of the board of directors of **ADS Inc** (ADS is list on the Montréal stock exchange market AAL.A)
1994	**ADS Groupe Conseil Inc**, Engineering Director of the office in Québec
1990	**ADS associés Ltd**, Administrator and member of the Executive Committee
1988-93	**Poly-Gérance Ltd**, Vice-President Construction (Turn-Key Project, Engineering Furnish and installed)
1980-88	**ADS associes Ltd**, Associate in charge of the Engineering office of Rimouski
1975-80	**Québec-Téléphone**, Director of the engineering group (telephone Company)
1970-75	**Québec-Téléphone**, Engineering

Professional summary

At the present time Mr. Dupuis holds the post of President and General Director (CEO) of Lithos and Limtech, Mr. Dupuis has acquired significant technical experience through his duties in traditional engineering and construction (turn-key projects). His vast range of management experience in the commercial, institutional and industrial sectors has resulted in truly extraordinary expertise. He constructed and started 14 plants around the world the last 10 years, mostly in textile and fiberglass processes (composite materials), all of them were successes stories. He won the first prize in Service Business of the year awarded for the rapid turnover, increase of the staff and the quality of professional services in Québec.

Conference-Related Press Articles

CANADA: A WINDOW ON GLOBAL MINING
World-Class Technology and Investment Prospects
Canadian Embassy, Tokyo, Japan
February 16 - 17, 1999

Tekko Shimbun (Metal and Technology Daily) February 17, 1999

Canadian Mining Seminar

Stimulating Japanese Investment

Mining Industry Chairman: "Relationship certain to Strengthen"

A seminar on the theme "Canada: A Window on Global Mining--World-Class Technology and Investment Prospects" began February 16 at the Canadian Embassy in Akasaka, Tokyo. It runs for two days and is being sponsored by the Canadian Embassy, Canada's Department of Foreign Affairs and International Trade, and Japanese mining and metal industry organizations.

In her welcoming remarks, Deputy Minister of Natural Resources Canada Jean McCloskey said "Canada is richly endowed in mineral resources and is a world leader in mineral exploration and production. Our economy is strong and our future is bright. Our business environment is stable and extremely attractive with an outstanding workforce and complete infrastructure. We welcome investment from Japan."

Speaking as a representative of the Japanese guests, Japan Mining Industry Association Chairman and Mitsui Mining and Smelting Co. President Shimpei Miyamura said in his opening remarks, "With stagnant demand, falling prices, and other problems, our country's nonferrous metal industry is in a very tough situation. I am confident that this seminar will give us an opportunity to exchange views about investment in Canada."

The seminar began with welcoming remarks by Canadian Ambassador to Japan Len Edwards, who said, "The Canadian mining industry has contributed significantly to the development of Canada-Japan economic relations thus far. I hope this seminar will further strengthen our business relationships."

In her welcome on behalf of the government of Canada which followed, Deputy Minister Jean McCloskey called for stepped-up investment from Japan, saying, "Canada is well endowed with resources such as copper, zinc, nickel, and gold, and now ranks as an international leader in the development of metallurgical resources. We are also a technological leader in mining exploration and production and are hard at work developing technology for the 21st century. I am proud to tell you that we are also a world leader in environmental policy. Up to the present, Japan has been an important trading partner for us in mining and metals. What we hope for now is an increase in investment activity. Canada has a strong economy and a stable tax system. Our fiscal policy is sound with low inflation and low interest rates. Our infrastructure is developed. There are virtually no investment barriers. Finally, free trade agreements put us in a favourable position with respect to the USA, Chile, and other countries."

Welcoming remarks were also made by Hiroaki Hiyama, President of the Metal Mining Agency of Japan. He said, "Recently our agency has been actively involved not only in mining exploration, but also in information services. Relations between Japan and Canada in mineral exploration and other areas have been very close. We now want to further strengthen the relationship by enhancing opportunities for investment.

Closing out the opening remarks and speaking as a representative of the Japanese guests, Japan Mining Industry Association Chairman Shimpei Miyamura said "The nonferrous metal and mining industry in our country is confronted by the five-fold problem of reduced demand, slumping prices, the high yen, reduced tariffs on metals, and tightened supply and demand for ore. To get out of the rut we are cutting costs, and I am confident that our efforts will eventually bear fruit. I am trying to convince the government that our most urgent issue is stable access to overseas resources. This seminar is an event whose time has come and I am certain that it will promote direct investment in Canada and as well as joint investments with Canadian enterprises.

Following the opening remarks the seminar got under way. The two days included about 20 presentations such as "The Strengths of Canadian Mining" and "Project Development Problems in Canada."

Photos:
Jean McCloskey, Deputy Minister of Natural Resources
Shimpei Miyamura, Chairman, Japan Mining Industry Association

(Canadian Embassy Translation Services, Tokyo)

Sangyo Shimbun (Daily Industry), February 17, 1999

Canada Mining and Investment Seminar

Attractive and Stable Environment

Japanese also emphasize advantages

A seminar on mining investment entitled "Canada: A Window on Global Mining," sponsored by the Canadian government and mining industry groups, is being held at the Canadian Embassy Theatre in Akasaka, Tokyo February 16 and 17. The seminar's aims are to give Japanese investors a broad view of Canada's mining investment opportunities and expand Japanese investment. Those themes were emphasized in opening remarks by Canadian Ambassador to Japan Leonard Edwards, Deputy Minister of Natural Resources Jean McCloskey, Metal Mining Agency of Japan President Hiroaki Hiyama, and Japan Mining Industry Association Chairman Shimpei Miyamura.

First speaker Dr. Dale L. Hull, Director of the Economic Analysis Division of the Minerals and Metals Sector of Natural Resources Canada, spoke on Canada's competitive advantage in mining and minerals. He said, "Canada is abundantly endowed in geological resources. It has an attractive and stable business environment, strong mining and mineral processing traditions, and a solid foothold abroad." He went on to explain the country's economic situation, the special features of its tax system, and its environmental regulations.

Another speaker called for an attitude of coexistence in dealing with aboriginal issues, explaining "You can have successful relations with the First Nations in the mining areas if you start out from the premise that you are coexisting parties in a joint venture."

Ambassador Edwards said in his opening remarks, "Canada is an exciting place to invest. It is a stable source of mineral resources and its environmental regulations are world class." Deputy Minister McCloskey said, "I would like to tell you all about the Canadian mining industry and Canada's mining expertise." President Hiyama said, "Our agency decided to co-sponsor this seminar because we knew it would be a valuable opportunity to exchange information with a country whose mining industry is very advanced. I believe that information exchange will reduce risk and lead to increased activity."

Finally Chairman Miyamura declared, "Japan's non-ferrous metal industry is in a very difficult situation facing a multitude of problems. But we are taking drastic action to cut costs which I believe will soon bear fruit. In that regard I use every opportunity I have to impress upon our government authorities the extreme importance of stable access to resources overseas. This seminar is truly, therefore, an event whose time has come and I am confident that through it we can have a free exchange of opinions leading to new ideas for direct investment in Canada as well as joint investment with Canadian enterprises in other countries."

(Canadian Embassy Translation Services, Tokyo)

Kogyo Shimbun (Mining News), Thursday, February 25, 1999 p. 1

Editorial

Canada's Amazing Resource Development Strategy

The World's No. 1 Producer of Mine Products

The Canadian Embassy in Japan held an investment seminar entitled "Canada: A Window on Global Mining--World-Class Technology and Investment Prospects" at the embassy in Aoyama, Tokyo February 16 and 17.

In the opening remarks on the 16th, Canada's Ambassador to Japan Leonard J. Edwards and Canada's Deputy Minister of Natural Resources Jean McCloskey gave warm welcomes to the Japanese enterprises in attendance.

In the following lectures entitled "Minerals and Mining: Canada's Competitive Advantage" and "Canada's Potential for New Mineral Wealth," Dr. Dale Hull, Economic Analysis Division Director of the Minerals and Metals Sector of Natural Resources Canada and Dr. Murray Duke, Director General of the Minerals and Regional Geoscience Branch of the Geological Survey of Canada of the Earth Sciences Sector of Natural Resources Canada deeply impressed the audience with their detailed explanations of Canada's mining laws, mining taxes, and current state of geological studies.

The mining situation in Canada's provinces of British Columbia, Saskatchewan, Ontario, Quebec, and Alberta as well as its territories of Yukon and Nunavut was also presented.

The latest information from Canada was presented the next day. It included Inco Limited's advanced mining and smelting technology, nickel products, mine automation, uranium mining, Noranda Inc.'s technology for growth, wet process nickel production technology, geological and prospect consulting, environmental technology, engineering and project management, and the challenges facing the Canadian coal industry.

Canada is presently the world's largest producer of mine products. Its mining companies are at work around the world and it is developing a resource strategy. Its domestic output of many mine products is the highest in the world, and if its worldwide resource development projects are included, it produces, on the average, an amazing twenty-plus percent of the world's output.

It has been pointed out that the growth of Canadian mining is the result not only of Canada's rich and diverse mineral endowment, but also of its highly developed exploration and mining technology as well as its preferential tax policies toward new investments in mining.

In Japan, on the other hand, the Japan Mining Industry Association is asking the government to improve and make permanent the special tax deductions (loss exemption system) for foreign and domestic exploration and reserve funds (special provision 58-2-3 of the tax code).

The assets of the mining industry are dwindling and non- renewable. Furthermore, once resources have been mined, new ones can be found only through explorations for new deposits, an undertaking that involves extremely high risk.

In manufacturing industries, investments on fixed assets are recovered by spreading the depreciation over a period of time. A mining company, however, cannot stay in business just recovering investments on fixed assets. To survive, it has to conduct new exploration and find new resources to replace those it has depleted.

Furthermore, a mining company cannot freely choose where it will work, and it is encumbered by natural factors such as the remoteness and depth of the resources. There is also the economic fact of inescapable price fluctuations. The mining industry is thus very special because it faces natural and economic challenges that other industries do not.

For these reasons, a system of tax deductions for depletion, which in the mining industry should be considered a form of depreciation, is essential to enable mining companies to maintain their capital, to stay in business, and to ensure a stable base for operations.

Japan is a resource-poor country. For our mining companies to assure a stable supply of mineral resources, participation in mining projects abroad is vital.

It is in the midst of such a situation that Canada a few other countries are consolidating their position as mining leaders and pushing ahead with high-risk projects. Meanwhile Japanese companies are trying to develop their overseas work actively while spreading out the risk, but they cannot do as much as they should because the terms governing the system of reserve funds for overseas exploration are unrealistic.

For that reason also, a better system of tax deductions for depletion is necessary to boost the competitiveness of Japanese mining companies.

(Canadian Embassy Translation Services, Tokyo)